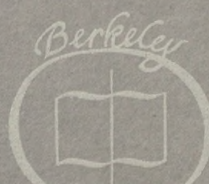
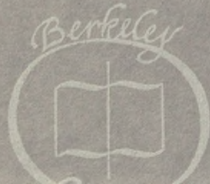
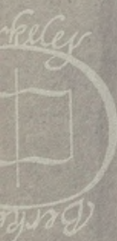
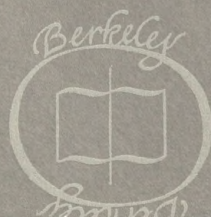
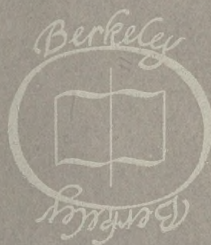
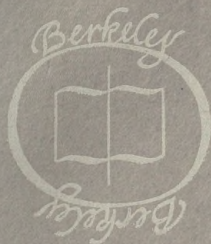


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WITH ILLUSTRATIONS OF THE SPECIES.

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GEORGE W. TRYON, JR.

CONTINUED BY

HENRY A. PILSBRY, Sc.D.,

SPECIAL CURATOR DEPARTMENT OF MOLLUSCA, ACADEMY OF NATURAL
SCIENCES OF PHILADELPHIA.

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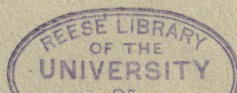
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PREFACE.

The greater part of this volume is occupied with a review of the family *Oleacinidæ*. This was undertaken primarily to find place for numerous species described originally as *Achatina*, *Stenogyra*, *Spiraxis* etc., in other systematic works referred mainly to the *Achatinidæ* or *Stenogyridæ*, but now known to belong to the *Oleacinidæ*. The work has been extended to supplement the account given in Vol. I of this series, bringing the subject up to date.

In order to define clearly the position of the *Oleacinidæ* in the system of land snails, the foundation of a new classification of the rapacious snails is briefly outlined, and evidence is presented to show the polyphyletic constitution of the so-called "Agnatha," or "Testacellidæ" of authors.

The remainder of the volume treats of the *Ferussacidæ*. This family has an extensive literature in four of five languages; the long list of described species is evidence of the tireless industry of erudite conchologists; and yet, we know so little of the creatures themselves that their classification is still purely guess-work. The best-known member of the group, *Cochlicopa*, is known, by data herein published, to be practically identical with the terrestrial *Achatinellidæ*. The pallial organs of other genera are unknown, but *Ferussacia* seems, from the published information, to be an Aulacopod snail. We look to European malacologists, to whom living material is accessible, for information on these little-known snails. The pedal grooves, pallial organs and genitalia of the common genera should be described.

In the work on Antillean *Oleacinidæ* I have had the advantage of using the great collection of C. B. Adams which the authorities of Amherst College with great liberality allowed me to study. A large number of Adams' types are

(iii)

here figured for the first time. I am also indebted to Mr. John B. Henderson, Jr., of Washington, D. C., who intrusted to me his rich collection of West Indian *Achatinidæ* and *Oleacinidæ*. Dr. W. H. Dall, whose kindness I have had so often to acknowledge in these pages, granted the use of various types in his custody from the National Museum. For all of these favors I am deeply grateful. H. A. P.

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ERRATA.

Page 125. Reference after 73, *V. guadeloupensis* should stand: Pl. 19, figs. 42, 43.



INTRODUCTION.

I. CLASSIFICATION OF THE AGNATHOUS SNAILS.

Most recent systematic writers follow the precedent of Dr. Paul Fischer in grouping all agnathous snails under one family, *Testacellidæ*, although Dr. Pfeiffer (1878) and Tryon (1885) had already recognized several family groups, based wholly upon conchological characters. In 1900 (Proc. Acad. Nat. Sci. Phila., p. 564) the writer admitted five families, placed in two super-family groups, thus: Agnathomorpha: *Glandinidæ*, *Rhytididæ*, *Streptaxidæ*, *Circinariidæ*. Agnatha: *Testacellidæ*.

Von Moellendorff and Kobelt, in the *Systematisches Conchylien Cabinet* (1902-1905) define ten families, which they refer to the single superfamily *Agnatha*. This view my anatomical studies do not support. Their *Agnatha* is in my opinion composed of three groups of totally independent origin—(1) *Ditremata* (family *Rathouisiidæ*), (2) *Agnatha* proper, a group related to the *Aulacopoda*, and (3) *Agnathomorpha*, allied to the *Holopoda*.

The agnathous family *Rathouisiidæ* Heude seems to be related to the *Veronicellidæ* (*Vaginulidæ*), representing a carnivorous branch of the *Ditremata*. The anatomy throughout differs fundamentally from other "Agnatha." The other families under consideration may now be arranged as follows.

AGNATHA: *Testacellidæ*, *Trigonochlamydidæ*.

AGNATHOMORPHA: *Aperidæ*, *Rhytididæ*, *Oleacinidæ*, *Streptaxidæ*, *Circinariidæ*.

The two superfamily groups *Agnatha* and *Agnathomorpha* are not even closely related and are readily separable by external characters. In my table of 1900 the *Agnathomorpha* correctly follow the *Holopoda*, but the *Agnatha* should have been bracketed with the next group, *Aulacopoda*.

SUPERFAMILY AGNATHA.

The AGNATHA have a distinct pedal groove, defining narrow foot-margins as in the *Aulacopoda*, and two lateral grooves diverge from the mantle forward. The teeth are all thorn-shaped, with single simple or barbed cusps. By secondary modification the shell in existing forms is much reduced or absent, and consequently no part of the viscera occupy a spiral protuberance. They are contained in the cavity of the foot which is excavated into the tail. The cerebral ganglia are generally united by a rather long commissure. The retractor muscle system is more or less modified, as is usual when the shell is reduced. The genital system is simple. The jaw is well developed in *Plutonia*, very weak and hard to distinguish in the Caucasian genera, and merely vestigial in *Testacella*.

The relationships of the *Agnatha* are with the *Aulacopoda*, not with the *Agnathomorpha*. The following families are distinguishable.

Family TESTACELLIDÆ Gray.

Mantle very small, posterior; shell external, Haliotoid or Vitrinoid, much too small to contain the soft parts. No distinct jaw. Palæarctic.

Testacellinæ: genus *Testacella*.

Dauebardiinæ, genus *Dauebardia*.

Family TRIGONOCHLAMYDIDÆ.

Mantle small or moderate, submedian, with posterior pneumostome, the tail behind it keeled. Shell internal, vestigial. Jaw more or less developed.

Trigonochlamydinæ. Caucasian genera with the jaw very weakly developed, shell minute or wanting, mantle marked with a curved groove. Palæarctic, Caucasus. Genera *Trigonochlams*, *Phryxolestes*, *Hyrkanolestes*, *Pseudomilax* and perhaps *Selenochlams*.

Plutoniinæ. Azores Islands; jaw well developed, smooth; shell Ancyliiform; no curved groove on the mantle. Genus *Plutonia*.

The position of *Selenochlamys* is uncertain. The genus is known only from two immature specimens. The keeled tail is like *Trigonochlamydinæ*, but the greatly reduced lunate mantle close to the end of the tail, and the apparent absence of a shell-plate, are peculiar features.

SUPERFAMILY AGNATHOMORPHA.

AGNATHOMORPHA are rapacious snails having *no distinctly developed pedal grooves*, the foot-borders being similar to those of *Helicidæ* etc. Lateral grooves, diverging forward from the mantle such as occur in *Testacella*, are not present, though there may be a groove from mantle-margin to the genital pore, such as that occasionally distinguishable in *Holopod* snails. The teeth are all thorn-shaped, with single simple aculeate cusps. The shell is ordinarily well developed, but there are exceptions (*Apera*, *Schizoglossa*, *Strebelia*) where it is reduced and incapable of containing the whole animal. The cerebral ganglia are concentrated, in close contact. A jaw is developed in the *Circinariidæ*, absent or merely vestigial in the other groups.

The affinities of this superfamily are with the *Holopoda* of my classification. The five families are apparently natural groups, but the want of anatomical data upon many genera leaves their characterization imperfect.

- a. Mantle apparently wanting, or restricted to a shell sack; there is a vestigial shell-plate under a posterior foramen. No jaw. Body slug-like, widest posteriorly. South Africa. *Aperidæ*.
- a¹. Mantle well developed, bearing a spiral external shell.
 - b. Pulmonary vein having numerous lateral branches, the venation of the lung sufficiently coarse to be distinct. No coherent jaw.
 - c. Shell Heliciform or Planorboid, (rarely reduced, Sigaretus-like), usually with distinct colored cuticle. Kidney lying parallel to the pericardium, which it surpasses in length. South Africa, Australasia. *Rhytididæ*.

- c*¹. Shell oblong, ovate-conic, subcylindric or turritate, usually with the columella truncate or sinuous at base. Kidney triangular, its longest axis obliquely diverging from the pericardium. Tropical American and Mediterranean. *Oleacinidæ*.
- b*¹. Pulmonary vein apparently without lateral branches, the lung without other noticeable (macroscopic) venation. Shell Planorboid, Helicoid or Pupiform, usually with smooth, thin, transparent cuticle (rarely yellow or dark); columella entire.
- c*. Jaw not distinctly developed. Kidney short, oval, transverse, extending across the base of the lung. Tropical. *Streptaxidæ*.
- c*¹. Jaw well developed, smooth. Kidney oblong, longer than the pericardium and parallel to it. America. *Circinariidæ*.

Family STREPTAXIDÆ Gray.

This family is African, Oriental and Tropical American. Little is known of the soft anatomy, but in *Streptaxis deformis* (Fér.), which I have dissected, it appears that the pallial organs differ widely from the *Rhytididæ*. The lung (pl. 52, fig. 5, *S. deformis*, Barbados) is long and narrow, with *no visible venation* except the pulmonary vein, a fleshy ridge accompanying this near its anterior end. The kidney is oval, transverse, extending across the base of the lung, with a sigmoid ureter and closed, tubular secondary or gut ureter. The cerebral ganglia are almost in contact, the commissure very short. The following genera are referred here: *Guestieria*, *Systrophia*, *Artemon*, *Streptaxis*, *Priodiscus*, *Imperturbatia*, *Glyptoconus*, *Micrartemon*, *Gibbus*, *Gibbulina*, *Ennea*, *Streptostele*, *Obeliscella*.

Family CIRCINARIIDÆ Pilsbry.

A wholly American group, closely related to the *Streptaxidæ* by the discoidal Helicoid shell and the lung, yet differing by the normal form and position of the kidney, and the

presence of a jaw. The lung (pl. 52, fig. 6, *C. vancouverensis*) has no noticeable venation except the pulmonary vein. The oblong kidney is longer than the pericardium, lying parallel to it. The gut ureter is closed throughout. The genital orifice is submedian, below the pneumostome. Spermatheca on a long duct, arising from the long vagina; epiphallus long. Genera *Circinaria*, *Scolodonta*.

The position of *Scolodonta* is somewhat uncertain, but at least one species has been shown to have a jaw. There are various degrees in the degeneration of the jaw in carnivorous snails, so that the value of this character is not great. As yet we know so little of the anatomy of South American Helicoid *Streptaxidæ* that the limits of the *Streptaxidæ* and *Circinariidæ* are uncertain.

Family APERIDÆ.

This family contains a single South African genus of several species, none of them yet thoroughly described anatomically. It may prove to be more nearly related to the *Rhytididæ* than to other Agnathomorph or Agnathous families. Genus *Apera* Heynemann (*Chlamydephorus* Binney, preoc. Vol. I, p. 17).

Family RHYTIDIDÆ Pilsbry.

This family is restricted to South Africa, Australia, New Zealand, New Caledonia, and neighboring islands of the "Melanesian plateau." *Schizoglossa* has a degenerate, *Daudebardia*-like shell, and much modified soft anatomy. Other genera have the shell Planorboid or Helicoid. The lung is rather short with distinct venation (pl. 52, fig. 1, *Natalina knysnaensis*). The reflexed ureter (fig. 1, r. u.) runs back to the base of the lung; thence a thickened band but no closed secondary ureter accompanies the last fold of the intestine. The shape and position of the kidney are as usual in Holopoda. Genera: *Schizoglossa*, *Paryphanta*, *Natalina* (*Aerope*, preoc.), *Rhytida*, *Rhenea* (*Elæa*, preoc.), *Diplomphalus*, and probably *Coxia*.

II. CLASSIFICATION OF THE OLEACINIDÆ.

Family OLEACINIDÆ Gray.

Oleacinidæ GRAY, Ann. Mag. Nat.-Hist. 1860, iv, p. 267.

Holopoda with a pair of dorsal but no lateral furrows; no coherent jaw; radula armed with unicuspid thorn-shaped teeth; cerebral ganglia concentrated, the commissure very short. Lung (pl. 52, fig. 7, *Oleacina oleacea straminea*) with dominant pulmonary vein and profuse branching venation; kidney triangular, the short side against the pericardium, whence it extends obliquely backward and towards the gut. Genitalia haplogonous or with accessory penial organs. Shell elongate, never depressed, spiral, generally capable of containing the soft parts, the aperture narrow or small, columella usually truncate or sinuous at base. Oviparous, the elliptical egg-capsules hard-shelled, roughened and white.

This family is chiefly tropical American, but one genus occurs in the Mediterranean region, and fossil forms occur throughout the European tertiaries. *Oleacinidæ* are active, rapacious snails, living in the haunts of ground-snails, upon which they chiefly feed. *Euglandina rosea*, which I have kept in captivity, perceives its prey from a distance of at least eight inches, whether by sight or odor is unknown. Gliding rapidly toward it, when within striking distance the *Euglandina* lunges swiftly, seizing the snail by the back. The almost instantaneous withdrawal of the victim into its shell does not loosen the hold of the *Euglandina*, which quits the feast only after the greater part has been devoured. In one instance, *E. rosea* was occupied eight hours in eating a large *Helix* (*H. vermiculata*), the fore part of the body being thrust into the aperture of the *Helix* so far that the peristomes of the shells were brought in contact. The actions of *Poiretia algira* have been described by Henking as similar to what I have observed in *Euglandina*. The stomach of *Euglandina rosea* frequently contains entire shells of small *Helices* which have been swallowed whole. The swift movements of *Euglandina* in attack contrast with the deliberation of most land snails.

The *Oleacinidæ*, while quite distinct, have much in common with the family *Rhytididæ*. The form and position of the kidney and the shape of the shell are the chief characters separating the two families. No other existing group is closely related.

Origin.—The family most closely related to the *Oleacinidæ* is an exclusively Old World group—the African and Australasian *Rhytididæ*. No fossil *Oleacinidæ* older than Pliocene are known in America, but as yet we know no brackish or fresh-water deposits of tertiary or mesozoic age in the American tropics, excepting the Oligocene Pebas beds, in which such shells would occur. In Europe, on the other hand, the *Oleacinidæ* have a continuous geological history from the present day back to the Cretaceous.

One Cretaceous species is from southern France (Provence), while in the Eocene and Oligocene, numerous forms occur as far north as the Isle of Wight. Miocene species are found in Germany, Bohemia and Italy. It is probable therefore that all known European *Oleacinidæ* belong to a single stock of which *Poiretia algira* and its allies are the sole survivors.

From jurassic to late tertiary time, the European localities are believed by those best qualified to judge—Neumayr, Koken and others—to have been separated by a “Mediterranean” sea from Africa. Their faunas are believed to have been in part insular, in part perhaps continental on a large “Scandinavian” land, which in the cretaceous extended probably as far southwest as Spain (See KOKEN, *Die Vorwelt und ihre Entwicklungsgeschichte*, plate I). It is extremely likely that from the Spanish area a peninsula extended southwest at least as far as Madeira. Later this land was more broken up. I believe on faunistic grounds that the common elements of the late Cretaceous and Eocene European faunas and the Brazil-Ethiopian continent, must be traceable to an earlier connection, or to a Cretaceous connection between Europe and Africa at present unrecognized by geologists. A later (Eocene) connection from Europe southward is improbable. Whether the *Oleacinidæ* arose in the north, on the Scandina-

vian Island of Neumayr, westward in the mid-American region, or on the Brazil-African continent—Archhelenis of von Ihering—must be an open question, with the probabilities favoring the latter hypothesis. In any case, it is certain that the American and Eur-African stock have been wholly separated as far back as the end of the Cretaceous period.

The soft anatomy of *Oleacinidæ* has been investigated most extensively by Hermann Strebel, who more or less fully examined *Pseudosubulina*, *Streptostyla*, *Strebelia*, *Salasiella* and *Euglandina*. I have dissected part of these groups and a few species of the additional genera *Oleacina* and *Varicella*. Simroth has given an account of *Poiretia*. The genera *Spiraxis*, *Rectoleacina* and *Oryzosoma* are unknown anatomically, and several of the others have been very imperfectly described; consequently no natural classification of all the genera is at present possible.

The classification of *Oleacinidæ* used by Tryon in Vol. I. of this work was practically that of Pfeiffer's *Nomenclator Heliceorum Viventium*, published in 1878, with some additional groups introduced by Strebel; yet Tryon was not influenced by the broad methods and spirit of Strebel's work. In the twenty-five years since Strebel's essays appeared, no taxonomic work has been done on the group. It is thus to be expected that a new examination of the soft parts and the shells themselves must result in an arrangement of genera and species widely different from that of Pfeiffer and Tryon.

The genera now known anatomically may be provisionally grouped as follows.

- a. Radula small, its length contained 8 or more times in that of the shell, the *transverse rows of teeth but slightly oblique*. Epiphallus terminating distally in a flagellum.

Varicella.

- a¹. Radula large, its length usually more than one-fourth that of the shell, the *rows of teeth very oblique, v-shaped*. Epiphallus terminating in the vas deferens only.

- b. Penis terminating in a blind sack.

- c. Penis with an appendix; labial processes long.

Lævoleacina.

*c*¹. Penis without appendix; labial processes short.

Poiretia.

*b*¹. Penis with no terminal blind sack.

c. Shell with Achatinoid columella and well developed spire.

d. An appendix on penis; penis retractor inserted on the epiphallus; shell glossy, minute.

Salasiella.

*d*¹. No appendix; shell larger.

Euglandina.

*c*¹. Shell well developed, capable of containing the soft parts, the *columella spirally curved*; appendix present or wanting; penis retractor inserted on the epiphallus.

Streptostyla.

*c*². Shell far too small to contain the soft parts, posterior in position; aperture about as long as the shell, the columella concave; spire minute; no appendix on the penis.

Strebelia.

Artificial Key to genera of Oleacinidæ.

a. Shell slender, turrit, small, *Subulina*-like; columella continuous or truncate at base.

Pseudosubulina, p. 1.

*a*¹. Shell ovate or oblong; or if small, slender and turrit the columella is spiral.

b. Columella truncate at base, Achatinoid.

c. Shell small or minute (length 12 mm. or less in known species), oblong or cylindric, with short spire, glossy and smooth, unicolorous. Mexican.

Salasiella, p. 170.

*c*¹. Shell glossy or weakly striate, with short spire and very long narrow aperture. Cuba, Haiti.

Oleacina, p. 127.

*c*². Shell striate, or glossy and smooth, spire shorter than aperture. American mainland.

Euglandina, p. 175.

*c*³. Shell striate with rather long spire. European.

Poiretia, p. 164

- c⁴. Shell striate, ribbed or grooved, with rather long spire, and more or less distinct varices. Antilles. *Varicella*, p. 46.
- b¹. Columella spiral, straightened or concave, not abruptly truncate at base.
 - c. Whorls 2; shell glossy, Bulla-like, with minute spire and concave columella. *Strebelia*, Vol. I, p. 22.
 - c¹. Whorls numerous.
 - d. Umbilicus perforate. *Oryzosoma*, p. 163.
 - d¹. Imperforate; columella spiral or straightened.
 - e. Spire long; surface ribbed, striate or grooved. *Spiraxis*, p. 11.
 - e¹. Spire rather short; surface smooth glossy. *Streptostyla*, p. 144; *Rectoleacina*, p. 142.

PSEUDCSUBULINA, SPIRAXIS.

What little is known of the anatomy of these forms is given in the text, pp. 1, 2, 11.

VARICELLA.

This genus is very distinct by the comparatively *small size of the buccal mass, radula and teeth*, and the *slight obliquity of the transverse rows of teeth*. In allied genera the buccal mass and radula are relatively very large, and the rows of teeth very oblique. The penis in *Varicella* has a rather long flagellum, and the vagina is extremely short.

The soft anatomy of *V. leucozonias*, the type species, is unknown. Of the Jamaican *V. nemorensis* I have examined a much hardened and contracted specimen. The back has the usual pair of grooves, the integument being elsewhere coarsely granulose. The foot is rather short. Whether labial processes are present could not be determined. The kidney is narrow, triangular, and about twice the length of the pericardium. The penis is rather long and simple. Its very

short retractor muscle is seated on the epiphallus, which terminates in a long slender flagellum (pl. 34, fig. 4, *fl*). The base of the spermathecal duct is globosely swollen (*sp. d.*). This inflation may be homologous with the sack-like inflation of the vagina in *V. denticulata suturalis*, described below.

The buccal mass is small and short, and the radula very small, about 2 mm. long in a shell 22 mm. long.

Varicella denticulata suturalis Pils., from Sans Souci. A specimen much hardened in strong alcohol was examined. The foot is much shorter than usual in *Oleacinidæ*, shaped more as in the *Achatinidæ*. No labial processes could be made out. The penis is long and simple. The vagina is dilated into an ample sack, somewhat bilobed above, and coarsely corrugated within. No other features could be distinguished (pl. 34, figs. 6, 7, lower portion of genitalia).

The buccal mass is comparatively very small for an *Oleacinoid* snail, and quite short, the radula about 2 mm. long in a shell 16 mm. long. This species belongs to a group probably separable from *Varicella s. str.* as a section or subgenus, comprising the Cuban, Haitian and Porto Rican species, no. 58 to 70 of my account (pp. 113 to 123).

The radula of *Varicella* is characterized by its very small size and *minute teeth*, and the *comparatively straight transverse rows*. In *V. nemorensis* and *V. denticulata* the radula is somewhat over 2 mm. long. *V. nemorensis* has *bow-shaped transverse rows* of teeth with 31,1,31 to 35,1,35 in different parts of the radula (pl. 37, figs. 25, 26). The central tooth is well developed, the laterals of the usual thorn-shaped form. *V. denticulata suturalis* has over 72 rows of 43,1,43 teeth, the rows very broadly v-shaped, the sides meeting at an angle of about 105 degrees (pl. 37, fig. 24). The central tooth is narrow but distinct, the laterals thorn-shaped, decreasing very gradually, and with many very small teeth at the sides. *V. semitarum* has 30,1,30 teeth (p. 46, pl. 25, fig. 2). *V. mandevillensis* has only 14,1,14 teeth (p. 50, pl. 25, fig. 1).

OLEACINA.

The soft anatomy of the type species, *O. voluta*, is un-

known. Four species of the subgenus *Lævoleacina* have been more or less fully examined. It remains to be seen whether the two groups are really referable to one genus.

The genitalia of *Lævoleacina* are very characteristic and quite unlike *Euglandina* and *Varicella*. In Cuban species examined the penis bears a well-developed appendix, and terminates in a hollow sack, beyond the insertion of the epiphallus. From its structure and position I do not believe this sack to be homologous with the flagellum of *Varicella*. The retractor of the penis is inserted on the epiphallus. The spermatheca is small on a very long duct.

Oleacina oleacea straminea (Dh.) from near Cienfuegos, pl. 33, fig. 9, has a long, narrow foot, 40 mm. long in an alcoholic specimen. The usual pair of dorsal furrows are well developed. The tail is very long and slender. It is pale yellowish, with a narrow purplish-brown stripe between the dorsal furrows and wider ones on both sides of the body. The tail has a median dusky streak. The labial processes are well developed, as in *Euglandina*. The genital system (pl. 35, fig. 12) has a long penis (*p*) terminating in a long terminal sack (*p. s.*) and a very slender epiphallus, which is a little swollen where it joins the vas deferens, and on which the retractor muscle (*r. p.*) is inserted. Very near the base of the penis there is an oval appendix (*app.*) This was collapsed or grooved in several specimens opened, as shown in figures 13 (median transverse section) and fig. 11; but in another the appendix was smooth and oval. The penis, to origin of the epiphallus is 10 mm. long, its terminal sack is 13.5 mm. long. The vagina is long. Spermatheca (*sp.*) oblong, on a very long duct (*sp. d.*). There is a very large prostate (*pr.*) and long oviduct, to which the duct of the spermatheca is closely bound throughout. The salivary glands are crescent into a compact mass.

O. SOLIDULA (Pfr.). Specimens dissected are from under an old tie in the yard of the T. & S. S. railway at Sancti Spiritus. Externally it is uniform whitish. There is the usual double dorsal groove, and short, triangular labial palpi. The penis is shaped like that of *O. o. straminea*, but its ter-

minal sack (*p. s.*) is very short and wide. The large ovate appendix is situated beyond the middle of the penis. The retractor muscle (*r. p.*) is inserted on the epiphallus, which is dilated at the end, and bears a small accessory sack (pl. 35, fig. 8).

In *O. orysacea* (Orb.), from Trinidad, Cuba, (pl. 35, fig. 9), the penis is stouter, with a much longer terminal sack (*p. s.*), and an oblong appendix (*app.*). The basal part of the epiphallus is partially enveloped in the penis-retractor muscle, some part of which reaches the apex of the penis. The spermatheca has a long duct.

In the Haitian *O. mülleri* from Charmettes, the penis (*p.*) is swollen distally and the appendix (*app.*) is very long and flagelliform (pl. 35, fig. 10). I could not ascertain whether there is a terminal sack as in Cuban species, the single specimen available having been broken in extracting from the shell. The spermatheca is ovate on a very long duct.

The peculiar appendix probably indicates that the Haitian forms should be separated from the Cuban as a distinct section of *Oleacina*, which may be called *Flavoleacina*, *O. mülleri* being the type.

The pharynx is very large, cylindrical and long in all the species examined, 18 mm. long in *O. o. straminea*.

The radula is comparatively large, as in most *Oleacinidæ*, 13 to 14 mm. long in *O. o. straminea*, 4 to 5 mm. in *O. orysacea* and *O. solidula*. The transverse rows of teeth are v-shaped, the sides meeting at an angle of about 90 degrees. In *O. o. straminea* the angle is slightly less, in *orysacea* and *mülleri* a little greater. The teeth show a good deal of diversity in the few species examined. *O. o. straminea* (pl. 36, figs. 17, 18, 14, 15) has 29,1,27 to 30,1,30 teeth in three radulæ examined. There are about 92 transverse rows. They are closely crowded, with long, rather weakly curved, lanceolate cusps. Figures 17, 15 show the teeth in their natural, crowded order; in fig. 14 they are slightly spread and pressed over on the side somewhat. The central tooth is narrow, its cusp nearly concealed by the much larger adjacent laterals. The latter decrease regularly in size. Fig. 18 shows a group of median teeth much more enlarged.

In *O. solidula* from Sancti Spiritus, the radula has 16,1,16 teeth. The base of the central is wide, its cusp very narrow. The side teeth decrease very slowly in size to the 7th, beyond which they diminish rapidly. The basal plates are curiously curved. The cusps are comparatively thicker and wider than in *O. o. straminea* (pl. 36, figs. 16, 19, 20).

O. orysacea from Trinidad, Cuba (pl. 37, fig. 27), has teeth of quite different type, formula 11,1,11. The side teeth increase in size from the first to the 5th. They have very short stout cusps, and wide basal-plates. The 7th tooth is abruptly smaller, and like those of the other species. This radula resembles that of *Salasiella*, and is more specialized than in other *Oleacinidæ* examined.

O. mülleri from Sans Souci, Haiti (pl. 37, figs. 21, 22, 23, 28), has 22,1,22 teeth, much like those of *O. solidula* but with more slender, graceful cusps. The central tooth (fig. 23 right hand figure, from above, fig. 23 left hand fig. obliquely from below) has the usual long, slightly curved cusp. The laterals decrease in size from the first. The outer ones are rather broadly lanceolate as seen from above (fig. 21), but from the side (fig. 20) they appear very narrow, the cusps being flattened. The radula, natural size, is drawn on the left of fig. 8, plate 25.

Rectoleacina.

Soft anatomy unknown. It will probably prove to resemble that of *Lævoleacina*.

POIRETIA.

By the shell this Mediterranean group seems related to *Euglandina*, but the soft anatomy is more that of *Lævoleacina*, the penis terminating in a similar blind sack. The salivary glands, if correctly figured by Raymond, are separate, while in American genera they are united. It should be noted that Raymond's figures of the genitalia of *P. algira* are quite incorrect. He mistook the penis for the spermatheca, and apparently lost the latter, but identified its duct as the penis.

Poiretia is undoubtedly distinct from all American genera. See p. 164.

In Upper Cretaceous, Eocene, Oligocene, Miocene and Pliocene deposits of central and western Europe, many species are found which from their close conchologic resemblance have been referred to the American genera *Glandina* (= *Euglandina*), *Salasiella* and *Oleacina*. There are no shell characters diagnostic of *Euglandina*, *Oleacina* and *Poiretia*, although these groups are perfectly distinct by characters of the genitalia. The variation in size, sculpture and shape among the European fossil and living forms is not greater than we find among American species of *Euglandina* or of *Oleacina*. It seems reasonable therefore to refer all European fossil "Glandinas" to the surviving European genus *Poiretia*, rather than to distribute them among several American genera as European authors have done. The American genera, it has been shown, have well-defined peculiarities of geographic distribution, which certainly indicate that they are the products of evolution on a progressively disintegrating Mid-American land-area. The genera *Oleacina*, *Varicella*, *Euglandina* and *Salasiella* must be considered by any one who fairly investigates their characters and distribution, to have been differentiated largely after the breaking-up of the old Mid-American continent; and it is highly unlikely that species of the European tertiary archipelago really belong to these four geographically characteristic American genera. At the same time, it must be admitted that Europe from the Eocene to the Miocene was largely insular, comparable to the East or West Indies, and evidently like the latter in having numerous parallel phyla in different parts of its interrupted land-area, and among them many phylogerontic groups. Hence the European tertiary *Oleacinidæ* may be referable to several collateral genera, rather than to the single surviving genus *Poiretia*; though no sufficient evidence for this has yet been published. In any case, there can have been no connection between European and American genera since mesozoic times, presumably before the several American genera had been differentiated. No conceivable scheme of geographic changes could be formulated to justify the reference of European species to *Oleacina*, *Varicella*, *Salasiella* and *Euglandina*.

The following list enumerates all the extinct European species referable to *Poiretia* or its immediate vicinity, so far as known to me. The species are entered under their original generic names.

Cretaceous.

Limneus affuvelensis MATHÉRON Catal. Méth., p. 214.
Glandina a., Sandberger, Land- und Süßwasser-Conchylien der Vorwelt, p. 93. Cretaceous, Provence.

Eocene.

Achatina cordieri DESH., An. s. Vert. Bassin Paris ii, 836.
 —*Glandina c.*, SANDBERGER, p. 233. GUTZWILLER Mem. Soc. Paleont. Suisse xxxii, 1905, p. 24. Upper Eocene, France, Switzerland.

Helicites cylindricus SCHLOTH., Petrefaktenkunde i, p. 109
 = *Achatina cordieri* Dh.

Glandina deschiensi BAYAN, Et. sur coll. Ecole des Mines, i, p. 2, pl. 10, f. 7, 1870. COSSMANN, Mem. Soc. Roy. Malac. Belg. 1889, p. 350, pl. 12, f. 9. Eocene Provence.

Glandina bonneti COSSMANN, Annales de la Soc. Royale Zool. et Malacologique de Belgique, xli, 1906, p. 278, pl. 6, f. 263-8 (Dec. 1907). Sparnacien inférieur, Grauves.

Glandina elongata MILLER, Jahresh. Ver. Naturkunde Württemb. Vol. 63, 1907, p. 453, pl. 9, f. 7. Eocene, Bachhagel.

Achatina fragilis DESH. An. s. Vert. ii, p. 839. Lower Eocene, Chalons sur Vesle.

Glandina longipontina BAYAN, Etudes sur coll. Ecole des Mines, i, p. 1, pl. 10, f. 3, 1870. *G. longipontiensis* COSSMANN, Mem. Soc. Roy. Malac. Belg. 1889, p. 349, pl. 11, f. 36. Eocene, Longpont.

Limnea naudoti MICHELIN, *Achatina n.*, DESH., An. s. Vert. Bassin Paris, ii, 837. Eocene, Provence.

Oleacina ovulina MILLER, Jahresh. Ver. Naturkunde, Württemb., vol. 63, 1907, p. 453, pl. 9, f. 9. Eocene, Germany.

Oleacina teres ROUIS, Sandberger, p. 232. Eocene, Buxweiler.

Achatina terveri BOISSY, Mem. Soc. Geol. France 1848, p.

279, pl. 6, f. 5.—DESHAYES, An. s. Vert. ii, 841, pl. 53, f. 23 25.—*Glandina terveri* COSSMANN, Mem. Soc. Roy. Malac. Belg. 1889, p. 350. Eocene, Rilly.

Glandina tournoueri DENAINV., Journ. de Conchyl. 1875, p. 73, pl. 3, f. 5. Eocene, Provence.

Glandina wagneri MILLER, Jahresh. Ver. Naturkunde Württemb. vol. 63, 1907, p. 453, pl. 9, f. 8. Eocene, Germany.

Oligocene.

Glandina brevis EDWARDS MS., NEWTON, Syst. List Edwards Coll., 1891, p. 275. TAYLOR, Monograph, p. 30, f. 48. Oligocene, Isle of Wight.

Bulimus convexus S. V. WOOD, Eoc. Moll. iv, p. 335, pl. 34, f. 6, 1877. *Glandina convexa* TAYLOR, Monograph British Land and Freshwater Moll. ii, p. 29, f. 46, 47. Oligocene, Isle of Wight.

Bulimus costellatus SOWB., Min. Conch. iv, p. 89 bis, pl. 336, 1823.—*Glandina costellata* SANDBERGER, p. 295. TAYLOR, Monogr. Brit. Land and Freshwater Moll. ii, p. 28. Oligocene, I. of Wight etc.

Glandina costellata var. *abbreviata* EDWARDS, Mon. Eoc. Moll. 1852, pl. 12, f. 1-k. *G. c. abbreviata* TAYLOR, Monograph, p. 29, f. 45. Oligocene, Isle of Wight.

Limnæa maxima SOWB., Min. Conch. vi, p. 53, pl. 528, f. 1, 1829. = *Poiretia costellata* (Sowb.)

Achatina vialai M. de SERRES, Ann. Sci. Nat. 1844, p. 179 = *B. costellatus* Sowb.

Glandina noueli DENAINV., Journ. de Conchyl., 1875, p. 72, pl. 3, f. 4. Upper Beaucechalk, at Dadonville, near Paris.

Glandina crassicosta SANDBERGER, Land- und Süßwasser-Conch. der Vorwelt, p. 356. MILLER, Jahresh. Ver. Vereins für vaterländische naturkunde in Württemberg vol. 63, 1907, p. 441, pl. 7, fig. 8. Oligocene, Germany.

Glandina ovata (Sandb. in litt.) MILLER, Jahresh. Ver. Naturkunde Württemb. vol. 63, 1907, p. 441, pl. 7, f. 9. Oligocene, Arnegg.

Miocene.

Achatina eburnea KLEIN, Württemb. Jahresh. ix, p. 213, pl. 5, fig. 10. *Oleacina eburnea* SANDBERGER, p. 606. Upper Mioc. Mörsingen.

Achatina elegans KLEIN, Württemb. Jahresh. ix, p. 214. Upper Mioc., Mörsingen.

Oleacina (Salasiella) fossilis ANDREAE, Mittheil. aus dem Roemer-Museum, Hildesheim, No. 18, Dec. 1902, p. 6, fig. 1. Miocene, Oppeln, in Schlesien (*Silesia*).

Achatina inflata REUSS, Paleontographica ii, p. 33. *Glandina i.*, SANDBERGER, p. 408. KLIKA, Die tert. Land- und Süsswasser-Conch. Böhmen, p. 20, f. 12.—Dainelli, Paleontographica Italica vii, 1901, p. 281. Lower Mioc. Bohemia, Germany, France.

Glandina cancellata SANDBERGER, Conch. Mainz. Tert. Beck. p. 46, pl. 5, f. 2 = *inflata* Reuss.

Achatina electa DESH. = *inflata* Reuss.

Oleacina neglecta KLIKA, Die Tert. Land- und Süsswasser-Conch. Böhmen, p. 21, f. 13, 1891. Lower Miocene, Bohemia.

Subulina nitidula KLIKA, Tert. Land- u. Süsswasser-Conch. Böhmen, in Archiv Naturwissensch. Landesdurchforschung von Bohmen, vii, no. 4, 1891, p. 70, fig. 66. Lower Miocene, Tucherie, Bohemia. Perhaps a *Subulina*, but it seems more likely to be a small *Poiretia*.

Achatina porrecta GOBANZ, Sandberger, p. 605. Upper Miocene, Germany.

Achatina producta REUSS, Paleontographica ii, p. 32.—*Oleacina p.*, SANDBERGER, p. 444. KLIKA, Tert. Land- u. Süsswasser-Conch. Böhmen, p. 23. Lower Miocene, Bohemia.

Oleacina producta var. *emphysematica* BABOR, Sitzungsber. k. bohmischen Gesellschaft der Wissensch., 1897, II, Art. 63, p. 2. Miocene, Tucheritz, Bohemia.

Glandina rugulosa SANDBERGER, Conch. Mainz. Tert. Beck. p. 391. Lower Mioc., Bavaria.

Achatina sandbergeri THOMÆ, Nass. Jahrb. ii, p. 151. *Oleacina s.*, SANDBERGER, p. 409. Lower Miocene, Germany, etc.

Achatina oligostropha REUSS = *a. sandbergeri* Thomæ.

Achatina subsulcosa THOMÆ, Sandberger, p. 410. Mioc., Germany.

Glandina taurinensis SACCO, I Moll. dei terreni Terz. del Piemonte, pt. 22, p. 56, pl. 4, f. 83, 84, and var. *melii* SACCO, t. c. p. 57, p. 4, f. 85. Miocene, Elvezian, colli torinesi.

Glandina pseudoalgira SACCO, 1884, = *Poiretia algira* var. *pseudoalgira* Sacco, t. c., p. 57, pl. 4, f. 86. Villafranchian, at Fossano and Tassarola.

Pliocene.

Achatina lunensis D'ANCONA. Sandberger, p. 744. Val di Magra, near Arezzo, Italy.

Glandina senesis Stef. Older Plioc. of Siena.

Bulimus aquensis MATHERON, Catal. Methodique du bassin du Rhone, p. 207, pl. 34, f. 8, 9.—*Glandina aquensis* SCHLOSSER, Neues Jahrbuch Min. Geol. und Pal., 1907, p. 19, pl. 1, f. 30. Eastern France, Spain.

Glandina aquensis var. *obtusa* DEPERET, Anim. plioc. de Roussillon, in Mem. Soc. geol. France, 1890, p. 176. Middle Plioc. of Roussillon.

Glandina paladilhei MICHAUD. Hauterive.

Glandina jobæ BOURGUIGNAT, Paleontologie des Mollusques terr. et fluv. de l'Algerie, Paris, 1862, p. 72, pl. 4, fig. 21. Telegraph Hill, Coudiat-Aty, near Constantine, Algeria.

Pleistocene.

Glandina antiqua ISSEL, cf. Bull. Soc. Geol. France (4), v, 1905, p. 593. Monaco. Not *Achatina antiqua* Desh., a species of *Lacuna*.

SALASIELLA.

The soft anatomy is described (after Strebel) on p. 170. In having an appendix on the penis, and the penis retractor muscle inserted on the epiphallus (pl. 25, fig. 9), this group resembles some forms of *Streptostyla*. It is somewhat more remotely related to the Antillean *Lævoleacina*, which differs by having a blind sack terminal on the penis. The reduced

number and specialized form of the teeth (pl. 25, fig. 7) are characteristic. *Oleacina orysacea* is the only form known to me having teeth at all similar. *Euglandina* is not nearly allied to these forms.

EUGLANDINA.

This genus is one of the simplest of the family in genitalia (pl. 34, fig. 5, *E. miradorensis*, after Strebel). The long penis has no flagellum. Its retractor muscle is terminal in the large typical species, but in *E. polita* it has apparently moved outward. There is no epiphallus distinctly differentiated from the vas deferens. The mantle over the liver has black markings. A crop is developed. The lip processes are very long, carried laterally with recurved ends.

The radula is large, with V-shaped rows of teeth (pl. 25, fig. 8, *E. rosea*, nat. size). The narrow central tooth has a small cusp. The side teeth increase in size and then gradually decrease (pl. 25, fig. 4, *E. rosea* Fér., Florida).

While the shell of *Euglandina* bears most resemblance to *Oleacina* and *Poiretia*, the soft anatomy has more in common with *Streptostyla*.

STREPTOSTYLA.

The animal resembles *Euglandina* externally. Internally there is also much resemblance to *Euglandina*, but no crop is developed. The genitalia (pl. 34, fig. 2, *S. coniformis*, after Strebel) show much variation in the species examined. Generally the penis is simple, with the retractor muscle inserted on the epiphallus, but in some forms, as *S. physodes* (pl. 34, fig. 3) there is a small appendix (lettered *g. m.* in the figure) at the base of the penis and the retractor is at the apex of the penis. These features recall *Salasiella* and *Lævoleacina*. The pharynx is large, as usual; oesophagus slender, the salivary glands conerescent in a ring around it. There is no crop, but a capacious stomach (pl. 34, fig. 1, *S. coniformis*, after Strebel). The soft anatomy, as well as the shells, have been most fully investigated by Strebel.

The subgenus *Peteniella* (p. 161) certainly resembles

Ferussacia in external anatomy, so far as the published account goes. Unfortunately its dentition and genitalia are unknown.

ORYZOSOMA.

This genus is anomalous in having a distinctly perforate axis. The early whorls are irregularly coiled, as in some species of *Streptostyla*. Von Martens would apparently place the group among the *Ferussacidæ*, but he had not seen specimens. I believe it will prove to be related to *Streptostyla* when the living animal is found. See p. 163.

STREBELIA.

The small Bulla-like shell of two whorls sits Testacella-like near the end of the comparatively large body. Conic labial processes are developed. The pharynx is very large, as usual, the radula being longer than the shell, with about 6,17,1,17,6 teeth of the usual form. Genitalia without accessory appendages, the penis-retractor inserted on the epiphallus. *The duct of the spermatheca is much shorter than the oviduct*, thus differing from other *Oleacinidæ*. The anatomy has been fully worked out by Strebel. Only one species known, *S. berendti* (Pfr.), Vol. I, p. 22.

This genus is the only Oleacinoid form in which the shell shows marked degeneration.





MANUAL OF CONCHOLOGY.

Family OLEACINIDÆ.

Most systematic writers on land snails, including Pfeiffer (*Nomenclaton Heliceorum Viventium*, 1878), have placed *Spiraxis*, *Melaniella* and the slender species of *Varicella* among or adjacent to the Stenogyroid *Achatinidæ*. Their true position proves to be in the family *Oleacinidæ*, which was monographed by Mr. Tryon in Vol. I of this series. Since species of these groups will naturally be looked for among the Stenogyroid groups, it has been thought best to insert them here. The opportunity has been taken to revise the classification of the *Oleacinidæ* and to supplement the account in Vol. I by illustrations and descriptions of new forms and of others published since the appearance of that volume, without duplicating matter contained therein.

Genus PSEUDOSUBULINA Strebel.

Pseudosubulina STREBEL, Beitrag Mex. Land und Süßwasser Conchyl. v, p. 117 (1882).—v. MARTENS, Biologia Centrali Americana, Mollusca, p. 301.—TRYON, Manual of Conchology, 2d. Series, i, p. 50.

The shell is slender and turrite, pale and subtransparent, closely resembling that of *Subulina*; but with fine rib-sculpture. Columella usually more or less distinctly truncate at the base. Apical whorl smooth.

The jaw is represented by a slight crescentic thickening of the epithelium, distinct on its lower border, but passing insensibly into the general integument at the sides and above. It is composed of narrow plates.

The radula is Oleacinoid, the teeth arranged in V-shaped rows. Central tooth rudimentary, with a small cusp. The

side teeth are unicuspid, the marginals with slender, thorn-like cusps.

Genitalia with the atrium swollen above; penis very short. The vagina is extremely long and rather thick. The spermatheca is globose, on a long, slender duct.

Type *P. berendti* Pfr. The species are chiefly Mexican, but a few Antillean snails seem to belong close to or in the same group.

Most of the following forms are unknown anatomically, and their reference to *Pseudosubulina* is in a greater or less degree provisional. The group is somewhat heterogeneous in conchological characters.

1. *P. LIRIFERA* (Morelet). Pl. 5, figs. 14-17.

Shell turritate-subulate, costulate, diaphanous, glossy, bright corneous; suture crenulate. Whorls 9 to 10, convex, the last less than one-fourth the length. Columella arcuate, callous, the base truncate. Aperture small, oval; peristome simple, thin, unexpanded. Length 12 to 13, diam. 3 mm. (*Morel.*).

Guatemala: Woods of Peten near San Luis (*Morelet*); Livingston (*Stoll*).

Achatina lirifera MORELET, Testac. Noviss. ii, p. 12.—*Subulina lirifera* CROSSE & FISCHER, Miss. Sci. Mex., Moll. i, p. 633, pl. 25, f. 12.—*Pseudosubulina l.*, MARTENS, Biologia, p. 304, pl. 17, f. 20.

Fig. 17 is copied from Crosse and Fischer's figure of one of Morelet's types. Figures 14-16 represent a shell from Livingston, illustrated by von Martens.

"The first two whorls are smooth, the third and fourth comparatively large, subglobose, and provided with strong, but narrow costae (fig. 15); on the fifth whorl commence the broad and flat costae, with very narrow interstices, the sculpture being similar on all the following whorls. The whorls are very feebly convex, rather flat, chiefly the lower ones; the last whorl, seen from the dorsal side, is two-sevenths of the whole length of the shell. The aperture is small, the columellar margin very concavely arcuated. The two examples from Livingston, on the Atlantic coast, are of larger

size than those described by Morelet, and Fischer and Crosse, viz.:—Specimen from Peten, whorls 9-10, length 12-13, diam. 3; aperture long. $2\frac{1}{4}$, diam. $1\frac{1}{2}$ millim.; specimen from Livingston, whorls $11\frac{1}{2}$, length 15, diam. $3\frac{1}{2}$; aperture long. 3, diam. $1\frac{1}{2}$ millim. Nevertheless, the specimens from Livingston agree so well with Fischer and Crosse's figure of *Subulina lirifera* that I do not think they can be separated, not even as a variety. The very concave shape of the columellar margin gives the species somewhat the facies of *Tornaxis*." (v. Mts.)

2. P. BERENDTI (Pfr.). Vol. I, p. 50.

Var. *occidentalis* PILS. Pl. 5, fig. 11.

The rib-striæ are a little more spaced than in *berendti*, and the columella is less distinctly truncate. Length 14, diam. 3, aperture nearly 3 mm.; whorls 12. The largest shell is 15 mm. long with 12 whorls.

Uruapam, State of Michoacan, Mexico (S. N. Rhoads).

P. b. var. occidentalis PILS., Proc. A. N. S. Phila. 1899, 398; 1903, p. 774, pl. 50, f. 1.

3. P. CHIAPENSIS (Pfr.). Vol. 1, p. 50.

4. P. SARGI (C. & F.). Vol. I, p. 50.

— *P. trochlea* Pfr., Vol. I, p. 50 = *Subulina octona*, q. v.

5. P. TRYPANODES (Pfeiffer). Pl. 5, figs. 12, 13.

Shell cylindric-turrite, rather solid, closely plicate, somewhat glossy, subdiaphanous, whitish-waxen. Spire subregularly tapering, rather obtuse; suture subcrenulate. Whorls 12, the upper very convex, the following flatter, last whorl scarcely one-fifth the total length, rounded below. Columella short, slightly arcuate, obliquely truncate. Aperture suboblique, elliptic-oval; peristome simple, the right margin slightly arched forward. Length 13, diam. 3, aperture 2.66×1.5 mm. (Pfr.).

Mexico:

Achatina trypanodes PFR., P. Zool. Soc. 1856, p. 379; Malak. Bl. 1856, p. 234; Monogr. Hel. Viv. iv, 616.—*Pseudo-*

subulina (?) *trypanodes* MARTENS, Biologia p. 303, pl. 17, f. 16, 16 a, b.

Distinguished from *P. fortis* by the number of whorls, 12 in a length of 13 mm. The figure is copied from the *Biologia Centrali Americana*, and represents the type specimen.

6. *P. TEXOLOENSIS* Pilsbry. Pl. 5, fig. 9.

Shell turrit, imperforate, faintly greenish yellow tinted, composed of numerous short, wide whorls, sculptured with close-set rib-striae separated by smooth, slightly wider intervals; outlines of spire decidedly concave above. Whorls $10\frac{1}{2}$, convex, the ribs subobsolete on the base of the last one. Apex obtuse, the first whorl rapidly widening, smooth, the second becoming very finely rib-striate, the next three whorls more coarsely ribbed, scarcely increasing in width or in the diameter of the spire; following whorls gradually widening and increasing the diameter of the spire; last whorl short, moderately convex, abruptly contracting below. Aperture ovate-trapezoidal; columella concave above, abruptly truncated, Achatina-like, at the base. Length 9.2, diam. 3, length of aperture 2.6 mm.

Mexico: Texolo, State of Vera Cruz (S. N. Rhoads.).

P. texoloensis PILS., Proc. A. N. S. Phila. 1899, p. 398; 1903, p. 774, pl. 50, f. 2.

The shortness of the whorls and contraction of the upper part of the spire (as in the young of many species of *Urocoptis*), are the more prominent features of this species. The columella is much more strongly truncated than in *P. berendti*.

7. *P. ROBUSTA* Martens. Pl. 5, fig. 20.

Shell imperforate, subconic-turrit, vertically closely costulate-striate, glossy, yellowish. Whorls 10, the first 2 subglobose, smooth, the third somewhat narrowed, from the fourth on regularly increasing and sculptured; suture rather impressed; the last whorl subconvexly tapering. Aperture rather oblique, oblong-trapezoidal, the outer margin arcuate above, then straightened, basal margin broadly rounded, columellar margin a little twisted, lightly thickened, whitish, at

base slightly truncate. Length 18, diam. 5, aperture 4.5×2.5 mm. Last whorl seen from the dorsal side, one-third of the whole length. (*Marts.*).

Southwestern Mexico: Omilteme, State of Guerrero, 8000 ft. elevation (H. H. Smith).

P. robusta MARTS., Biologia p. 304, pl. 17, f. 19. (April, 1898).

8. *P. FORTIS* Martens. Pl. 5, fig. 19.

Shell imperforate, cylindric-turrite, distinctly costulate, the riblets rather wide, about equal to the interstices; rather solid, pale grayish-yellow. Whorls 9 to $9\frac{1}{2}$, a little convex, suture deep, crenulate; the last whorl slowly narrowing below, the base rather smooth. Aperture narrowly oblong, the outer margin slightly arcuate, basal rather short, columellar margin *subvertical*, thick, oblique and slightly truncate. Length 13-14, diam. 4, aperture 4×2.25 mm. (*Marts.*)

W. Guatemala: El Repose, 800 ft., Las Mercedes, 3000 ft., and Zapote (Champion); Miramar near San Francisco and Retalhulen (Stoll).

P. fortis MARTS. Biologia p. 304, pl. 17, f. 17. (April, 1898).

"Last whorl, seen from the dorsal side, one-third the total length. The deep sutures are often filled with dirt, and thus appear dark brown."

9. *P. MITESCENS* Martens. Pl. 5, fig. 10.

Shell imperforate, subulate-turrite, costulate-striate, the riblets rather flattened, wider than their interstices, *obsolescent* below in the antepenult, penult and last whorls; diaphanous, yellow, glossy. Whorls 10, the first small, subglobose, the second much larger, those following rather flat, suture narrowly impressed, crenulate, brownish; antepenult and penult whorls sparsely marked with spiral linear impressions; last whorl smooth at the base, rapidly narrowing. Aperture narrowly oblong, the outer margin slightly arcuate, basal rather short, columellar margin *subvertical*, thick, obliquely and slightly truncate. Length 16, diam. 4, aperture 4×2.33 mm. (*Marts.*)

W. Guatemala: Duenas, near Antigua, 5000 ft. elevation (Champion).

P. mitescens MARTS., Biologia p. 304, pl. 17, f. 18. (April, 1898).

"Intermediate between *P. fortis* and *P. lirifera*—in the sculpture and the flatness of the costæ resembling the latter, and in the shape of the aperture the former; costæ stronger on the upper whorls and becoming very feeble in the lower parts of the last three whorls, this character being quite peculiar to the species." (*v. Mts.*).

10. *P. SALVINI* Martens. Vol. XVIII, pl. 39, fig. 38.

Shell subulate-turrite, rimate, perpendicularly closely striatulate, glossy, whitish. Whorls $8\frac{1}{2}$, a little convex, the suture rather deep; first whorl subglobose, papilliform, rather large, the rest regularly increasing, the last whorl rapidly narrowing at base. Aperture subvertical, trapezoidal, outer margin subrectilinear, basal margin narrowly rounded, columellar margin oblique, protuberant in the middle, obliquely subtruncate at the base. Length 10, diam. 2.5, aperture 1.66×1.33 mm. (*Marts.*)

N. Guatemala: Vera Paz (Salvin).

Achatina trypanodes Pfr., TRISTRAM, P. Z. S. 1863, p. 411, not of Pfr.—*Pseudosubulina* (?) *salvini* MARTENS, Biologia, p. 305, pl. 17, f. 21 (April, 1898).

"A comparison of our figure of this shell, drawn from Salvin's specimen, with fig. 13 of pl. 5, taken from the type of *P. trypanodes* (Pfr.), will show the differences between these two forms. It is somewhat strange that this species should not be found amongst the numerous Guatemalan shells described by French authors, but I cannot identify it with any of those enumerated in Fischer and Crosse's work; the nearest seems to be *P. sargi*, from which the present species may be known by the less convex whorls, the stronger sculpture, and the different form of the outline of the columellar margin. The last-mentioned character makes it even doubtful whether this shell belongs really to the genus *Pseudosubulina*." (*v. Mts.*)

11. *P. ORIZABENSIS* Pilsbry, n. sp. Pl. 2, fig. 26.

Shell imperforate, turrit, slender, thin, whitish corneous, glossy. Sculptured with thread-like vertical riblets which *distinctly project above, denticulating the suture*. On the last three whorls these riblets are widely and unequally spaced, with some fine striæ in the intervals; on earlier whorls the riblets are finer, regular and much more crowded. The first $1\frac{1}{2}$ whorls are smooth, the next whorl very finely striate. The base of the last whorl is striate but not ribbed. The outlines of the spire are nearly straight, but a little concave near the obtuse summit. Whorls 9, moderately convex. Aperture small, subvertical. Columella simple and vertical, with reflexed and adnate edge. Length 8, diam. 2.2, aperture 2.1 mm.

Mexico: Orizaba, State of Vera Cruz (Heilprin Exped. 1890). Type 61545 A. N. S. P.

Pseudosubulina (Volutaxis) miradorensis PILS., Proc. A. N. S. Phila. 1891, p. 312; cf. Martens, Biologia p. 639. Not *V. miradorensis* Strebel.

The widely spaced riblets, producing small but distinct denticulations along the suture, are the most prominent feature of this species, which I formerly mistook for *S. miradorensis* Strebel.

12. *P. IRREGULARIS* Pilsbry, n. sp. Pl. 6, fig. 24.

Shell imperforate, turrit, thin, whitish-corneous, sculptured with *very irregularly spaced* unequal, subvertical thread-like riblets, wanting on the first $1\frac{1}{2}$ whorls and very weak on the base of the last whorl. Apex obtuse. Whorls 10, moderately and equally convex. Aperture small, rhombic-ovate, subvertical. Columella straight and vertical, very slightly and inconspicuously excavated at the base. Length 9, diam. 2.2, length of aperture 2.2 mm.

Mexico: Texolo, State of Vera Cruz (S. N. Rhoads, 1889).

Chiefly characterized by its very irregularly spaced riblets. Five specimens were taken.

13. *P. BOREALIS* (Pilsbry). Pl. 6, figs. 21, 22.

Shell wholly imperforate, turrit, very slender and long,

regularly tapering to the obtuse summit, thin, whitish-corneous. Sculptured with close, delicate, vertical, thread-like riblets scarcely half as wide as the intervals. Whorls 12, convex, the first smooth, separated by deep sutures. Aperture small, ovate, the lip thin and simple; columella thin, concave, passing without notch into the basal margin, though a very indistinct angle is traceable at the base of the columella, in an oblique view. Length 10, diam. 2, length of aperture 2 mm.

N.-E. Mexico: Diente, near Monterey, State of Nuevo Leon. (S. N. Rhoads).

Spiraxis (?) *borealis* PILS., Proc. A. N. S. Phila. 1903, p. 775, pl. 50, f. 6, 6a.

This species agrees fairly well with the description of *S. acus* Shuttl., from Cordova, V. C., except in the smaller size. The typical form of that species has not been figured. In sculpture *S. borealis* is not unlike *S. intermedius* Strebel, but that species is less slender and has a sinuous, not simply concave, columella. The generic position is uncertain, but I am now disposed to think it a *Pseudosubulina*.

14. *P. EISENIANA* (Cooper). Pl. 6, fig. 32.

"Shell sinistral, with a thin brownish epidermis, first two nuclear whorls white, smooth, turbinate, third narrower, and with the rest covered with numerous vertical riblets, increasing to about 50 on body-whorl, where they curve round the base and end at the edge of lip. Whorls 17 to 19 regularly and slowly enlarging from the 3d to the body-whorl, which is contracted about one-third, flattened, sutures moderately impressed, truncating the riblets. Penultimate whorl swollen, largest, narrowing towards mouth, which is ovate, acute at junction of lips, of which the outer crosses the inner, ending at the suture (suture). Length about 0.55 inch, breadth 0.08; mouth 0.08 long, 0.09 wide. Shell transparent." (Cooper).

Lower California (Dr. G. Eisen).

Melaniella (?) *eiseniana* COOPER, Proc. Cal. Acad. Sci. 2d Ser., iii, p. 339, pl. 13, f. 3 (May 5, 1893); iv, p. 141, pl. 6,

f. 20. *Pseudosubulina eiseniana* Cooper. DALL, Proc. U. S. Nat. Mus. xix, p. 364, 1896.

"Fourteen found by Dr. Eisen under stones living, but the epidermis being destroyed by alcohol, they do not have exactly the color of fresh ones." (*Cooper*.)

Dr. Dall states that this species and the next have the nuclear whorls delicately ribbed. *P. eiseniana* has no jaw; radula with 13,1,13 slender, arched, needle-like teeth.

15. *P. TASTENSIS* (Cooper). Pl. 6, fig. 33.

"Shell dextral, much elongate, white, translucent, nuclear whorls as in *M. eiseniana*, third less narrowed, sculpture nearly similar, whorls 14 to 16, longer and less oblique, 14 of them equaling 16 in that species. Outline of whorls flatter, mouth vertically longer, body-whorl not contracted, peristome not continuous, the lip being separated by the parietal wall about 1-20 of an inch. Whole shell a fifth longer, with the same number of whorls. Length 0.74 inch, breadth 0.08; mouth 0.10 long, 0.06 wide." (*Cooper*.)

Lower California: Six only were found at Saltito Pass, just north of El Taste Mountains, at 3,200 feet altitude.

Melaniella tastensis COOPER, Proc. Cal. Acad. Sci. 2d ser., iv, p. 141, pl. 6, f. 21. (April 25, 1894).

"In some the upper 6 or 7 whorls are much slenderer, proportionately, than the rest, as if they were starved when young, and often bent out of the straight course, as shown in figure.

"Found under damp wood on the ground at the end of the wet (summer) season. Only two of them have 16 whorls, one 13, and three 11, these being immature." (*Cooper*.)

16. *P. EXILIS* (Pfeiffer). Pl. 18, fig. 29.

Shell minute, acicular, the apex obtuse, hyaline or very pale corneous, under a lens seen to be longitudinally subarcuately rib-striate, whorls 8 to 9, narrow, flattened, the last slightly more than one-fifth the total length; columella subarcuate, obliquely truncate at the base of the oval-elliptic aperture; peristome simple, acute. Length 5.33, diam. 1.5, aperture 1 x .5 mm. (*Pfr.*).

Cuba: Matanzas (Pfr., type loc.); Managua (Poey); Rangel (Arango). Under dead leaves.

Achatina exilis PFR., Archiv f. Naturg. 1839, i, p. 352; Monogr. ii, 268.—*Subulina e.*, ARANGO, Fauna Malac. Cubana, p. 99.—CROSSE, J. de C. 1890, p. 248.—*Achatina michaudiana* ORB., in Sagra's Historia etc., Moluscos, p. 90, pl. 11 bis, f. 7, 8, 9 (erroneously marked *A. consobrina* at foot of plate).

The specimen figured measures 4.5 x 1.1 mm., with 7½ whorls, being the largest of five before me. The summit is obtuse; first half whorl smooth, very delicate striæ then beginning. These increase in size gradually upon the narrow, attenuate portion of the shell, and more rapidly where the diameter begins to increase. The later whorls might better be described as grooved rather than as rib-striate. The grooves are slightly arcuate and very much narrower than their flat intervals. They become weaker or subobsolete on the base of the last whorl. The columella is concave above, and subvertically truncate basally.

Figure 62 of plate 44, vol. XVIII, represents the synonymous *A. michaudiana* of Orbigny. In the *Historia*, Orbigny's references to the illustrations of *A. consobrina* and *michaudiana* were transposed, both in the text and in the legend at foot of the plate. The error was repeated in the later French edition.

The systematic position of this species is not certain.

P. exilis has a superficial resemblance to *Spiraxis melanieloides*, but the columella is of quite different shape. It is a *Subulinoid* species, not unlike the lengthened Antillean *Leptinarias*. I have been in doubt as to its real position, which can only be demonstrated by study of the soft parts. It does not seem referable to *Varicella*, though having some characters of the section *Varicellula*.

17. P. (?) PROBLEMATICA Pilsbry, n. n. Pl. 20, figs. 2, 3.

The shell is minute, imperforate, pure white, slender, and tapers slowly to the obtuse summit. The first whorl is smooth, riblets beginning on the second. The later whorls are rib-striate, the riblets not more than half as wide as the smooth

interstices. Whorls $6\frac{1}{2}$, very convex. Aperture ovate, the outer lip arching strongly forward in the middle (fig. 3), thin and unexpanded. Columella very short, excavated above, somewhat straightened in the middle, curving below into the basal margin. Length 2.5, diam. 0.7, length of aperture 0.7 mm.

Jamaica (Adams coll., Amherst College Mus.).

Bulimus minimus C. B. ADAMS, Contrib. to Conch. no. 2, p. 28 (October, 1849).—PFR., Monogr. iii, p. 441.—REEVE, Conch. Icon. v, pl. 84, f. 623 (bad), (Dec. 1849). Not *Bulimus minimus* Brug., Encycl. Méth. p. 310 (1789).

The systematic position of this peculiar little shell is uncertain; it may possibly be an operculate. From the structure of the columella it is surely not an *Opeas*, and I have placed it with the preceding species as a temporary expedient, until living specimens can be studied. In his description Adams mentions spiral striæ, which I did not see when drawing the figures; yet as I have not the specimen at hand for renewed examination, I cannot deny their presence. The above description is from my notes on the type.

Genus SPIRAXIS C. B. Adams, 1850.

Spiraxis AD., Contributions to Conchology no. 6, p. 87 March, 1850, for *S. inusitata*, *S. aberrans* and *S. costulosa*. SMITH, Journ. of Conch. viii, p. 235 (type *S. inusitata*).

Not *Spiraxis* Newberry, Ann. N. Y. Acad. Sci. iii, p. 219, 1884, for *Spiraxis major* and *S. randalli* Newb., based upon coprolites of the Chemung shark *Cladoselache*; cf. Trans. N. Y. Acad. Sci. xiii, 118.

Small, turrite or long-ovate *Oleacinidæ*, with the columella ascending in a spiral curve which projects into the aperture more or less, and at the base curves into the basal lip without truncation or excision, sometimes having a callous lamella superposed upon the convex columella. Embryonic whorls smooth, or after the first whorl, striate.

Type *S. inusitata* Ad. Distribution, Antilles and Mexico.

Spiraxis is related to *Pseudosubulina* and *Varicella*. It is apparently a very old phylum, which was evolved

before the separation of the Antillean and mainland areas. The subgenus *Volutaxis* contains the more primitive forms. It occurs in both areas, though sparingly in the Antilles. In Jamaica the most evolved forms are found, the restricted subgenus *Spiraxis* representing a gerontic phylum. In another Jamaican series, *Sigmataxis*, the shell has varix-lines and resembles *Varicella* except in its columella. The exact rank and relationships of the several Spiraxoid phyla, here treated as subgenera, must depend upon the morphology of the soft parts, of which we know practically nothing. There is, however, every reason to believe that the sigmoid columella in *Spiraxis*, as in *Streptostyla*, *Rectoleacina* etc., was derived from a truncate, Achatinoid columella. A similar transformation has been noted in several groups of *Achatinida*.

Spiraxis was proposed for the species *inuitata* Ad., *aberrans* (Pfr. ?) Ad., and *costulosa* Ad. The diagnosis applies particularly to the first and last of these species, while the second fits it only imperfectly. Adams' first species is therefore taken as the type of *Spiraxis*. The limits of the genus were only imperfectly perceived by Adams, but he saw clearly the necessity for a genus to contain Jamaican species which were not referable to *Bulimus* or *Achatina* as those groups were then limited. Shuttleworth, in 1852, enlarged *Spiraxis* to cover *Streptostyla*, *Columna* and *Clavator*, which have since been segregated as distinct genera, but which have in common a spirally twisted and not truncate columella. In associating *Spiraxis* with the Oleacinoid *Streptostyla*, Shuttleworth did not go far astray, although we now understand the resemblance in columellar structure to be due to convergent modification in the two groups. It was a step backward when *Spiraxis* was placed among the Stenogyroid snails.

Numerous species now placed in other groups were originally described as *Spiraxes*.

The following belong to STREPTOSTYLA: *Spiraxis auriculacea*, *biconica*, *boucardi*, *catenata* Pfr., *cobanensis* Tristr., *coniformis* Sh., *dubia* Pfr., *flavescens*, *irrigua*, *lurida*, *limnei-formis*, *mitriformis* Sh., *mohriana* Pfr., *nicoleti* Sh., *oblonga*,

parvula Pfr., *physodes* Sh., *shuttleworthi*, *subcallosa*, *turgidula* and *ventricosula* Pfr.

To LEPTINARIA belong: *S. aequatoria* Mill., *guatemalensis* C. et F., *mexicana* Pfr., *simplex* Gupp. and *venezuelensis* Pfr.

To CURVELLA: *S. pusilla* Blf.

To TORTAXIS: *S. mandarina* Pfr., *permira* and *pilsbryi* Anc., and *pfeifferi* Mke.

To PROSOPEAS: *S. haughtoni* Bs., *S. hebes* Blf., *S. walkeri* Bs.

To SYNAPTERPES: *S. incerta* Mss., *S. bistorta* Pfr. (?).

To OPEAS: *S. layardi* Bs.

To FERUSSACIA: *S. barclayi* Pfr.

To DIGONIAxis: *S. cingalensis* Bs.

To CARELIA: *S. cumingiana*, *paradoxa* and *newcombi* Pfr.

To COLUMNA: *S. columna* Shuttl.

To CLAVATOR: *S. eximia* Shuttl.

To OBELISCUS: *S. dunkeri* Pfr.

Spiraxis major and *S. randalli* Newberry, 1884, = coprolites of *Cladoselache*.

Spiraxis obsoleta Pfr. = *Leptachatina*.

Spiraxis sandwichensis Pfr., Proc. Zool. Soc. Lond. 1856, p. 335, no. 54, and Monographia iv, 575 (Sandwich Is., Newcomb in Cuming coll.) is stated by Mr. Sykes to be *Bulimus lactifluus* Pfr. (see vol. x, p. 140). *Spiraxis sandwichensis* Pfr., of Borscherding, (Achantinellen-Fauna der Sandwich-Insel Molokai, Zoologica xix, 6te Lieferung, Heft 48 II, 1906, p. 136, pl. 9, f. 10, 10 a), is probably *Opeas mauritianum* Pfr., which has been found on Maui (see pp. 133, 134 of vol. XVIII).

Spiraxis ? *bickhardti* Boettger (Nachrbl. D. Malak. Ges. 1896, p. 17), from the German Lower Miocene Corbicula beds at Offenbach a. M., would hardly fall into *Spiraxis* as here restricted. It probably represents an Oleacinoid group parallel to *Streptostyla*.

Various other species have been referred by some authors to *Spiraxis*, but were originally placed elsewhere, and are not now retained in the genus. They need not therefore be enumerated here.

Key to Sections of Spiraxis.

- I. Columellar fold or lamella very strongly projecting into the aperture; outer lip more or less toothed within.
 - a. Having an internal parietal lamella.
 - Section *Spiraxis*, species no. 1, 2.
 - a¹. No parietal lamella. Section *Euspiraxis*, sp. 3, 4.
- II. Columellar fold long and but weakly projecting into the aperture.
 - a. Columella straight, subtruncate at base, with an oblique fold superposed above.
 - Section *Biangulaxis*, sp. no. 48.
 - a¹. Columella simple.
 - b. Outer lip with a prominent internal tooth.
 - Section *Ravenia*, sp. no. 5.
 - b¹. Outer lip thin and simple.
 - c. Shell turrite, with short whorls; and no color-streaks or varix-lines.
 - Section *Volutaxis*, sp. no. 6 to 33.
 - c¹. Shell oblong-turrite usually with longer whorls, very glossy, marked with grooves and a few inconspicuous varix-lines generally preceded by colored streaks; never rib-striate.
 - Section *Sigmataxis*, sp. no. 34 to 46.
 - c². Shell oblong-turrite, rib-striate, with colored streaks.
 - Section *Glandinella*, sp. no. 47.

Section *Spiraxis* Adams, s. str.

The turrite shell is composed of 7 to 9 whorls, the first smooth, some early ones finely costulate, contracted, the last 4 or 5 sculptured with *spaced ribs with striae in the intervals*. Aperture 8-shaped, contracted in the middle by a tooth in the outer lip and a very strong projecting spiral columellar lamella, penetrating more than one whorl. There is a *long parietal lamella within the last whorl*, not visible at the mouth. Type *S. inusitatus*.

These shells remind one of *Pineria* and *Geoscala* in the

Urocoptidæ. The embryonic shell resembles that of *Pichardiella*.

1. *S. INUSITATUS* (C. B. Adams). Pl. 1, figs. 1, 2.

"Shell elongated, gradually tapering in the upper half, cylindrical in the lower half, wide and blunt anteriorly, with a broad very deep constriction about the middle of the last whorl; dingy white; with very distinct lamelliform transverse ribs, about ten on each whorl, with strong irregular intervening striæ; spire with convex outlines; apex small; whorls nine, very convex, with a deeply impressed, and near the apex a channelled, suture; last whorl small and very short; aperture ovate, acute above, much modified by the constriction of the last whorl, which constriction bends the sharp labrum into two large arcs of small circles; columella remarkably twisted and arcuate. Length .16 inch; breadth .05 inch; length of aperture .033 inch." (Adams.)

Jamaica:

Achatina inusitata C. B. AD., Contrib. to Conch. no. 2, p. 26 (Oct. 1849).—*Spiraxis i*, AD., Contrib. no. 6, p. 88.—PFR., Monogr. iii, 471.

This species is related to *S. mirabilis*, but the whorls are less swollen, the ribs not so prominent and the columella is distinctly truncate at its base. It is dull buff-white, with about five ribbed whorls, those above being finely and delicately costulate and more drawn out. The first whorl seems to be smooth. The spire is suddenly attenuated above the ribbed whorls, as in *S. mirabilis*. Within the last whorl or more there is a peripheral row of small denticles, usually visible through the shell as pale or opaque spots. Length 4, diam. 1.1 mm., with 9 whorls.

The columellar lamella enters somewhat more than one whorl, but the axis is simple and straight in the second whorl from the base as well as in all preceding ones. Below the main lamella of the axis there is a second much smaller one, terminating at the base of the columella which appears obliquely truncate. In the last whorl there is a strong parietal lamella, which does not extend to the aperture (fig. 2).

2. *S. MIRABILIS* (C. B. Adams). Pl. 1, fig. 3.

"Shell rather long and conic, with two-thirds of each whorl enormously inflated, gradually more abruptly with the progress of growth, so as to give to the shell the form of a screw; subtransparent, whitish; with numerous microscopic spiral striæ, and very distant transverse erect lamellar ribs, which have smooth rounded edges, and are most elevated at the summit of the convexity of the whorls, and diminish much over the anterior extremity of the shell; spire with rather convex outlines; apex with the inflation proportionally much longer and the ribs slightly elevated; whorls about seven, with an indistinct suture; aperture modified by the form of the last whorl at its termination, and by the remarkably prominent and much twisted columella, nearly into the form of the figure 8. Length .1 inch; breadth .062 inch." (*Adams*).

Jamaica:

Bulimus mirabilis C. B. Ad., Contrib. to Conch. no. 2, p. 29 (Oct. 1849).—REEVE, Conch. Icon. v, pl. 84, f. 622 (Dec. 1849).—*Spiraxis mirabilis* Ad., Contrib. no. 9, p. 168.—PFR., Monogr. iii, p. 472.

Adams' description is given above. The first whorl is smooth or nearly so, and strongly elevated. The second and third whorls have delicate longitudinal riblets or laminæ at rather wide intervals. Then the adult sculpture of strong, compressed, triangularly projecting ribs sets in. These ribs are strongest on the greatly swollen upper half of each whorl; and when broken are seen to be hollow. The surface between is finely striate spirally; color grayish corneous. Length 3.6, diam. 1.5 mm.

The internal structure is like *S. inusitatus* except that the parietal lamella is not so strong in the specimens opened, and there is no minor axial lamella below the large one.

There is no material variation in the series I have seen in the Adams and Academy collections.

Section *Euspiraxis* Pfeiffer.

PFR., Malak. Bl. ii, 1855, p. 167; no diagnosis, no type selected.—MARTENS, Die Hel. 1860, p. 34, type *S. costulosa* Ad.

Shell similar to *Spiraxis s. str.*, but regularly tapering, evenly, finely ribbed, with no parietal lamella. Type *S. costulosus*.

Euspiraxis was instituted without definition by Pfeiffer in 1855 for what he intended as the typical group of *Spiraxis*, comprising the following species: *acus* Shuttlw., *costulosa* Ad., *inuitata* Ad., *brevis* Ad., *aberrans* Pfr., *consimilis* Rve., and ? *paludinoïdes* Orb. In 1860 von Martens selected *Sp. costulosus* Ad. as the type. Although Pfeiffer's intention was clearly to coin a new name for the typical Spiraxes, as is shown by his inclusion of all of Adams' species in his list, yet since von Martens selected *costulosa* as the type, it seems allowable to restrict Pfeiffer's group to species of the *costulosa* group. If we take the *first species* of Pfeiffer's list as type of *Euspiraxis*, the name will replace *Volutaxis* of Strebel.

Euspiraxis was enlarged from time to time by the addition of species from the Antilles, the Oriental region and other places until it became a heterogeneous assemblage of forms belonging to two or three families and many genera. It is now restricted to two small Jamaican species, closely related to typical *Spiraxis*.

3. *S. COSTULOSUS* C. B. Adams. Pl. 1, figs. 4, 5.

"Shell elongate-conic; whitish or horn colored; with thirty-five or forty obtuse approximate transverse ribs: apex obtuse; spire with the outlines almost rectilinear except near the apex; whorls seven and one-half, very convex, with a deep suture; last two or three whorls with a spiral constriction on the middle, which gradually increases to the labrum, which is much indented by it; columellar lamina large. Mean divergence about 13° ; length .175 inch; breadth .04 inch." (Adams).

Jamaica:

Spiraxis costulosa C. B. Ad., Contrib. to Conch. no. 6, p. 88 (March, 1850).—Pfr., Monogr. iii, p. 470.

In perfect adult individuals there is a callous tooth within the outer lip, and the peripheral constriction is marked inside by more or less callous deposits, such as the related species

show. It is related to *S. anomalus* rather than to *inuitatus*, but is distinct by its small size and closely placed riblets. The axial lamella is strong in the last whorl but does not penetrate much deeper. It is more oblique than in *S. inuitatus*, and there is no parietal lamella (fig. 5). Length 4, diam. 1 mm., whorls 7. Adams' type specimen is a trifle larger but otherwise exactly similar to that figured.

4. *S. ANOMALUS* (C. B. Adams). Pl. 1, figs. 6, 9.

Shell imperforate, narrowly turrit, rather solid though thin; the dead specimens known are of a gray-whitish tint and without luster. Sculpture of rather close, very delicate longitudinal riblets, nearly straight on the spire, somewhat sinuous on the last whorl. Spire straightly tapering, the apex obtuse. Whorls $9\frac{1}{2}$ to 10, decidedly convex, the last one or two flattened peripherally. Aperture subvertical. Outer lip thin, bearing a tubercular tooth in the middle and often others back of it in the throat. Columella concave below, very strongly twisted above, into an entering lamella which projects strongly into the aperture.

Length 8, diam. 2, aperture 1.7 mm., whorls $9\frac{1}{2}$ (Ad. coll.).

Length 8.8, diam. 2, aperture 2 mm., whorls 10 (Henderson coll.).

Length 6.9, diam 1.7 mm., whorls 9 (Henderson coll.).

Jamaica: Manchester Back Mountains (Chitty, type loc. of *S. contorta*); Ipswich (Jarvis).

Bulimus anomalus C. B. ADAMS, Contrib. to Conch. no. 2, p. 28 (Oct., 1849); not *Bulimus anomalus* Pfr. of Albers, 1850, *Achatina anomala* Pfr.—*Spiraxis anomalus* C. B. AD., Contrib. no. 9, p. 168, 184.—*Spiraxis adamsiana* PFR., Zeitschr. f. Malak. 1852, p. 178; Monogr. Hel. Viv. iii, 473.—*Spiraxis contorta* CHITTY, Contrib. to Conch. no. 1, p. 16 (Oct., 1853).—*Ravenia hollandi* HENDERSON, Nautilus xii, p. 25, fig., July, 1898.

In the C. B. Adams collection there is one broken shell, the original type, and a perfect but "dead" one evidently added later, and shown in my fig. 6. A broken shell in coll. A. N. S. is like these. The type of *R. hollandi* (fig. 9) is a trifle more

slender but otherwise exactly similar. Chitty's *S. contorta* was based upon a specimen of *S. anomalus*. It measured 7.5 x 1.75 mm., with 10 whorls.

Pfeiffer changed the name of Adams' species on account of his own earlier *Achatina anomala*, which he transferred to *Spiraxis* in 1853; but that species is a *Leptinaria* and was not referred to *Bulimus* or *Spiraxis* until after the publication by Adams of his *B. anomalus*.

4a. *S.* (?) *PARVULUS* (Chitty).

"Shell sub-cylindrical, whitish with a yellowish epidermis, with strong transverse striae on the last 5 whorls, becoming obsolete on the lower extremity of the last whorl. The apex quite free from striae. Spire with almost rectilinear outlines. Apex very obtuse. Whorls 7, rather turreted; last whorl much so. At one-half of the labrum the aperture is singularly constricted, and there is a large opal white tooth, at the point of constriction; thence it is very abruptly truncated, and the labrum thickened; the columella is considerably thickened; and is also of an opal white. Aperture very long, much twisted and sub-angular above. Mean divergence about 12°. Length .14, breadth .04, length of aperture .04, Habitat —? From Dr. Hyde." (*Chitty*).

Achatina parvula CHITTY, Contrib. to Conch. no. 1, p. 14 (Oct., 1853).—PFR., Monogr. iv, p. 618.

A problematic Jamaican snail, known to me by the above description only.

Subgenus *RAVENIA* Crosse.

Ravenia CROSSE, Journ. de Conchyl. xxi, 1873, p. 69; xxii, 1874, p. 67, for *R. blandi* Crosse, t. c. p. 69, pl. 2, f. 4.

This group has been included in Vol. I by Mr. Tryon, p. 52. It seems to be very closely related to *Euspiraxis*, differing only by the slightly thickened outer lip, which has a more prominent angle in the middle, as seen in profile view, than the Jamaican forms. The columellar lamella is not quite so prominent. These differences would not be thought of much importance were it not for the remoteness of the local-

ity of *Ravenia*, which was found on Los Roques, an islet lying east of Buen Ayre and Curaçao, off the coast of Venezuela.

5. S. BLANDI (Crosse). Vol. I, p. 52.

Subgenus VOLUTAXIS Strebel.

Volutaxis STREBEL, Beitrag zur Kenntniss Mexikanischer Land und Süsswasser Conchylien v, p. 110 (1882), first species *V. sulciferus*.

Shell imperforate, turritate, thin, vertically striate or ribbed, glossy, whitish-corneous or pale yellow; whorls 5 to 13, slowly increasing, the first $1\frac{1}{2}$ forming a *smooth* obtuse summit. Aperture small, the outer lip thin and simple, arcuate, the columella spirally twisted (or sometimes nearly straight), slightly thickened, not truncate.

Type *S. sulciferus* Morelet.

Part of the species have already been treated of by Tryon in vol. I of this work. The others known up to this time are described below.

In *Volutaxis* the shell is less specialized than in typical *Spiraxis*; the whorls are shorter and more convex than in *Sigmataxis*. All the Spiraxes known from Mexico and Central America belong to this group, together with a few from Jamaica, Cuba and Haiti. Some East Mexican forms diverge from the typical Volutaxes by having a nearly straight columella, not perceptibly sinuous; and a few (species 21 to 23) are distantly grooved, also with the columella straight. The generic place of these species is uncertain; but they surely do not belong to *Opeas*, where some of them were originally placed, and the straight columella removes them from *Sigmataxis*.

I. Mexico and Central America, species 6 to 29.

II. Cuba, species 30.

III. Haiti, species 31.

IV. Jamaica, species 32, 33.

6. *S. SCALARIOPSIS* (Morelet). Pl. 2, fig. 17.

Shell imperforate, long-turrite, thin, subdiaphanous, with rather distant acute longitudinal riblets; uniform pale buff-whitish. Spire long, the apex rounded, obtuse; suture rather deeply impressed. Whorls 9, convex, rather swollen, the embryonic first $1\frac{1}{2}$ smooth, the following longitudinally obsoletely multistriate, the rest costulate; last whorl much shorter than the spire, less remotely ribbed, somewhat tapering at base. Aperture small, angulate-ovate; peristome simple, buff-whitish, the margins separated, columellar margin straight, receding, subreflexed, twisted within above, forming an angle with the rounded basal margin; outer margin subflexuous, acute. Length 11, diam. 4, aperture 2.25×1.5 mm. (*C. & F.*)

Guatemala: dense woods of the province Peten, under rotten logs. (*A. Morelet*).

Bulimus scalariopsis MOREL., Testacea Novissima ii, p. 11 (1851).—PFR., Monogr. iii, 393.—*Spiraxis* s., FISCHER & CROSSE, Miss. Scient. Mex., Moll., p. 609, pl. 25, f. 1.—MARTENS, Biologia p. 308.

The ribs are more widely spaced than in other known species.

7. *S. SULCIFERUS* (Morel.). Vol. I, p. 51.

Var. *cobanensis* Marts.

Var. *berendti* Pfr. Vol. I, p. 51.

8. *S. TENUIS* Pfeiffer. Pl. 2, fig. 18.

Shell imperforate, conic-turrite, thin, closely thread-costulate throughout, pellucid, greenish-hyaline. Spire regularly tapering, the summit rather obtuse. Suture crenulated with very minute folds. Whorls 9, a little convex, the last slightly exceeding one-fourth the total length, rounded at base. Columellar plate slightly twisted, somewhat calloused, resembling an oblique truncation of the base. Aperture slightly oblique, subrhombic-oval; peristome simple, unexpanded. Length 8, diam. of last whorl 3 mm., aperture 2.25 mm. long. (*Pfr.*).

Mexico: Orizaba (*Sallé*).

Spiraxis tenuis PFR., Malak. Bl. xv, 1868, p. 84; Monogr. viii, 257.—FISCHER & CROSSE, Miss. Sci. Mex., Moll. i, p. 614, pl. 25, f. 5.—MARTENS, Biologia Centr. Amer., Moll., p. 309.

“Related to *Sp. acus* Shuttl. and *euptychus* Pfr. but distinguished from them by the very thin, pellucid shell with rather obtuse apex, and the equally close costulae throughout.” (Pfr.).

9. *S. URUAPAMENSIS* Pilsbry. Pl. 2, figs. 12, 13.

Shell turreted-conic, decidedly tapering, the lateral outlines a little concave above; corneous, with white riblets; apex obtuse. Whorls $7\frac{1}{2}$, very convex, separated by deeply impressed sutures; first half whorl smooth, following whorl very finely lamellose-striate; succeeding whorls with numerous, delicate, raised riblets, about 42 in number on the penultimate whorl. Aperture short-oval, somewhat trapezoidal; columella thick, strongly sinuous. Length 5.2, diam. 2 mm.

Mexico: Uruapam, State of Michoacan.

Spiraxis uruapamensis PILS., Proc. A. N. S. Phila. 1899, p. 398; 1903, p. 775, pl. 50, f. 9, and fig. between 9 and 10.

This species is more obtuse than *S. sulciferus* and its variety *berendti*; has more convex whorls than *S. tenuecostatus* Streb., and is stouter than *S. miradorensis* Streb., with closer riblets. *S. tenuis* is an allied form which should be compared.

10. *S. SCALELLA* Martens. Pl. 2, fig. 16.

Shell conoid-turrite, sculptured with straight, compressed, close riblets, yellowish-white, diaphanous; whorls 5, regularly increasing, very convex below the suture, the last a little concavely tapering at the base. Aperture ovate, narrowed below, the columellar margin moderately twisted, thin. Length 2.33, diam. .75, aperture .66 x .5 mm. (Marts.).

Costa Rica: El Pital, in the valley of the Rio Naranjo (Pittier).

Spiraxis scalella MARTS., Biologia p. 311, pl. 18, f. 5 (April, 1898).

“In the very convex whorls this species resembles *S. scalariopsis*, and it might also be compared with a *Scalaria*, but the

costæ are much more numerous and more feeble. As I have seen only one specimen, and the number of the whorls is rather few for this genus, it may perhaps be not full-grown, but I know no other species to which it could be referred." (v. Mts.)

11. *S. ACUS* Shuttleworth. Vol. I, p. 52.

12. *S. MIRADORENSIS* Strebel. Pl. 20, fig. 4.

The single example possessed by Strebel is stated to differ from *S. berendti* in the following respects: It is much smaller; the shape is more slender, more regularly and slowly tapering upwards, the whorls more obliquely coiled, and somewhat terrace-like at the suture, the last somewhat flattened laterally. The strong ribs, which project over the suture, stand comparatively farther apart, about 22 on the penult whorl. The columella is strongly twisted, and stout, as in *berendti* and *sulciferus*. In color and size it resembles *similaris*, but differs by its step-like, more convex whorls, more widely spaced ribs, and the stouter, more spiral columella; yet it may only be a local form of *similaris*.

Another form has much more delicate closer ribs, and a weaker, less sinuous columella, approaching *similaris*, but it is more slender than that, with more separated, more regular ribs. Length 5.2 x 1.3 mm., with 8 whorls.

Mexico: Mirador, State of Vera Cruz.

Volutaxis miradorensis STREBEL Beitr. v, p. 122, pl. 17, f. 23, 35 (1882).—*Spiraxis* m., MARTENS, Biologia, p. 309, not p. 639.

13. *S. TENUECOSTATUS* Strebel. Vol. I, p. 51.

14. *S. SIMILARIS* Strebel. Vol. I, p. 51.

15. *S. CONFERTECOSTATUS* Strebel. Vol. I, p. 51.

16. *S. INTERMEDIUS* Strebel. Vol. I, p. 51.

17. *S. CONFERTESTRIATUS* Strebel. Vol. I, p. 52.

18. *S. NITIDUS* Strebel. Vol. I, p. 52.

Var. *major* Martens, pl. 2, fig. 14. Length 10 to 11.5, diam. 2.5, aperture 2 x 1 mm., 9 to 10 whorls. Las Vigas (Höge). The type is probably immature.

Var. *minor* Martens. 5.66 x 1.33 mm., with $8\frac{1}{4}$ whorls. Pacho, Canino de Obispo and Mirador (Strebel).

Var. *pittieri* Martens, pl. 2, fig. 15. More elongate, smooth, with 10 whorls, the apex globose, very obtuse. Length 10, diam. 2, aperture 1.66 x 1.25 mm. El Pital and Savana de Guacimo, in S. W. Costa Rica (Pittier). Probably a distinct species.

19. *S. TAMPICOENSIS* Pilsbry, n. sp. Pl. 20, fig. 1.

The shell is long and very slender, acicular, corneous-whitish, thin, composed of $7\frac{1}{2}$ whorls, which are strongly flattened, but separated by a deep suture. The summit is very obtuse; first $2\frac{1}{2}$ or 3 whorls are nearly smooth; then riblets weakly appear, gradually becoming stronger, until on the later 2 or 3 whorls they are conspicuous, very oblique and nearly straight ribs, parted by weakly, finely striatulate spaces two or three times their width. There are also, in the largest examples, a narrow varix or two, larger than the ribs. The aperture is very oblique, oblong, broadly rounded basally. The outer lip is narrowly expanded, very strongly arcuate near the upper insertion, where it runs horizontally. The columella is broadly concave below, entering in a low fold above. The internal axis has a low spiral prominence running nearly to the summit. Length 3.9, diam. .85 mm.

Tampico, northeastern Mexico, in river débris. (A. A. Hinkley).

This is quite unlike any form of *Spiraxis* or *Pseudosubulina* known to me, by its very oblique sculpture and aperture, the horizontal insertion of the outer lip, which moreover is noticeably expanded, and by the very narrow contour of the whole shell. Its generic position is somewhat uncertain.

20. *S. COSTATOSTRIATUS* (Pfeiffer).

Shell imperforate, turritate, thin, closely striate and having

irregular riblets, diaphanous, waxy-hyaline. Spire regularly tapering, rather acute. Whorls 7, a little convex, the last two-sevenths the length, rounded basally. Columella rather straightened, thread-like. Aperture slightly oblique, oblong; peristome simple, unexpanded, with subparallel margins, the columellar margin simple. Length 7.5, diam. 2.5, aperture 2×1 mm. (*Pfr.*).

Mexico: Cordova, State of Vera Cruz (Sallé).

Bulimus costatostratus PFR., P. Z. S. 1856, p. 319; Monogr. iv, 460.—not *Opeas* c., Crosse et Fisch., Moll. Mex. p. 598, pl. 26, f. 5.

This form differs from *Opeas beckianum*, *O. micra* etc. by its imperforate axis and thread-like columella. It has not been figured, and its relationships with the numerous Spiraxes and Pseudosubulinae of East Mexico remain to be worked out. *O. costatostratus* of Crosse and Fischer is apparently a form of *O. micra*, and not in my opinion the true *costatostratus* of Pfeiffer, which will prove to belong, I think, to *Volutaxis* or *Pseudosubulina*.

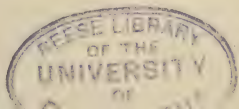
21. *S. ODIOSUS* (Pilsbry). Pl. 2, figs. 19, 20.

Shell slender, turrite, completely imperforate, corneous, sufficiently translucent to show the columella faintly through. Surface glossy, irregularly scored by unequally spaced longitudinal grooves and some slight wrinkles. General outlines of the spire straight; apex obtuse. Whorls $8\frac{1}{2}$, the earlier strongly convex, the last two slightly flattened. Aperture ovate; outer lip thin, moderately arched forward, columella concave, forming a distinct angle with the parietal wall. Alt. 7.1, diam. 2, longest axis of aperture 1.8 mm.

Mexico: Patzcuaro, State of Michoacan (Rhoads).

Opeas odiosum PILS., Proc. A. N. S. Phila. 1899, p. 399; 1903, p. 775, pl. 50, f. 3.

The impressed, widely-spaced grooves are similar in character to those of *Vitrea indentata* Say. It is related to *S. patzcuarensis*, but differs by its much larger size, concave columella and tapering spire.



22. *S. RHOADSÆ* (Pilsbry). Pl. 2, figs. 21, 22.

Shell slender, subulate, imperforate, corneous, and sufficiently translucent to show the internal axis through the shell in places. Surface glossy, sculptured with unequally spaced longitudinal grooves, and showing a few slight growth-wrinkles in places. General outlines of the spire straight. Apex obtuse. Whorls 9 to $9\frac{1}{2}$, the earlier ones quite convex, the later four or five somewhat flattened. Aperture small, ovate, the outer lip a trifle curved forward in the middle; columella slender, concave.

Length 7, diam. 1.9, longest axis of aperture 1.6 mm.

Length 7, diam. 1.7, longest axis of aperture 1.6 mm.

Mexico: Diente, near Monterey, State of Nuevo Leon (Mr. and Mrs. Rhoads).

Opeas rhoadsæ PILS., Proc. A. N. S. Phila. 1899, p. 399; 1903, p. 775, pl. 50, f. 4.

Similar in sculpture and color to *S. odiosus*, but perceptibly more slender in the spire, with smaller apex. These two species have the general form of *Opeas gracile*, but differ totally in sculpture; they are also more brilliant and more transparent. The columella is not at all twisted, and there is no trace of a basal notch or truncation. This species, of which about fifteen specimens were obtained, is named in honor of Mrs. Mary C. Rhoads.

23. *S. PATZCUARENSIS* (Pilsbry). Pl. 2, fig. 23.

Shell minute, imperforate, subcylindric, very slowly tapering to the obtuse summit, whitish-buff. Surface glossy, smooth except for rather widely spaced, rather inconspicuous longitudinal grooves. Whorls $7\frac{1}{2}$, the early ones quite convex, later whorls moderately so, the last tapering basally. Aperture irregularly ovate, nearly vertical, the outer lip curving forward a little. Columella vertical in front view, but convex in the middle when viewed obliquely in the aperture. Length 3.1, diam. 1 mm., aperture .7 mm. long.

Mexico: Patzcuaro, State of Michoacan (Rhoads).

Opeas patzcuarense PILS., Proc. A. N. S. Phila. 1899, p. 399; 1903, p. 775, pl. 50, f. 5.

Very small, cylindric and obtuse, with somewhat the appearance of *S. linearis*, from which it differs in sculpture.

24. *S. LINEARIS* Pfr. Vol. I, p. 52.

25. *S. BLANDI* Crosse & Fischer. Vol. I, p. 52.

26. *S. RHABDUS* Pilsbry, n. sp. Pl. 6, figs. 25, 26.

Shell imperforate, very slenderly turrit, thin, whitish corneous, somewhat translucent. Sculpture of even, vertical, rounded riblets as wide as their intervals; the embryonic whorls and the base are smooth. Spire slowly tapering to an obtuse summit. Whorls 10, moderately convex, separated by deeply cut narrow sutures. Aperture small, ovate; columella nearly straight, a trifle concave, not spirally twisted. Length 6, diam. 1.3, length of aperture 1 mm.

Mexico: Texolo, State of Vera Cruz (Rhoads).

Chiefly notable for its very slender figure and the straight, not sinuous columella. The sculpture is decidedly coarser than in *S. delicatus*. An example of *S. rhabdus* 4 mm. long has $8\frac{1}{2}$ whorls, a more regularly tapering spire than *S. delicatus*, and the base of the last whorl is entirely smooth.

27. *S. STREBELI* Pilsbry, n. sp. Pl. 6, figs. 27, 28.

Shell imperforate, turrit, thin, whitish corneous and somewhat translucent. Sculpture of fine, even, subvertical ribstræ, as wide as their intervals, the first $11\frac{1}{2}$ whorls smooth. Spire regularly tapering to the obtuse summit. Whorls $7\frac{1}{2}$, very convex, parted by deep sutures. Aperture subvertical, the outer lip thin, slightly arched forward. Columella subvertical in front view, but very weakly spiral as seen obliquely in the aperture. Length 4.5, diam. 1.5, length of aperture 1.25 mm.

Mexico: Texolo, State of Vera Cruz (S. N. Rhoads).

While closely related to *S. delicatus*, this species is much more robust. Some dead specimens before me are larger than the type, 5.5 mm. long, with 8 whorls.

28. *S. DELICATUS* Pilsbry, n. sp. Pl. 6, fig. 23.

Shell imperforate, very slender, turrit, thin and some-

what transparent, whitish corneous. Sculpture of fine, even, subvertical rib-striae, as wide as the intervals, the striae becoming wider on the last whorl; the first $1\frac{1}{2}$ whorls smooth. Spire straightly tapering, the summit obtuse. Whorls 8, very convex, separated by deep sutures. Aperture small, ovate, subvertical; outer lip simple. Columella nearly vertical in front view, but weakly spiral as viewed obliquely in the aperture. Length 4, diam. 1.1, length of aperture 1 mm.

Mexico: Uruapam, State of Michoacan, type loc.; Texolo, Vera Cruz. (S. N. Rhoads).

29. *S. CACAHUAMILPENSIS* Herrera. Pl. 2, figs. 24, 25.

Undescribed, and known from the figures only. These have not much the appearance of *Spiraxis*, yet no doubt belong to a species distinct from any described.

Mexico: Cavern of Cacahuamilpa, State of Guerrerro.

Spiraxis c., HERRERA, Memorias y Revista de la Sociedad Cientifica "Antonio Alzate," v, 1891, p. 219, pl. 2, f. 4, 5.

30. *S. MELANIELLOIDES* 'Gundl.' Pfr. Pl. 6, figs. 29, 30, 31.

Shell imperforate, subulate, rather thin, closely subarcuately striate, pellucid, waxy. Spire slender, the apex rather acute. Whorls 8, a little convex, the last not one-fourth the total length, somewhat flattened laterally, very obsoletely angular at the base. Columella somewhat thickened, twisted, not truncate. Aperture subvertical, truncate-auriform; peristome simple, thin, the right margin somewhat arched forward. Length 6.5, diam. 1.66, aperture scarcely 1.5 mm. long. (Pfr.).

Cuba: Brazo del Cauto, near Santiago; found on rotten logs in woods, after rain. (Gundlach).

Spiraxis melanielloides Gundlach, Pfr., Malak. Bl. v, p. 184 (1858); Monographia vi, p. 192.—*Sp. melanielloides* Gundl., ARANGO, Fauna Malac. Cubana, p. 93.—*Volutaxis melanielloides* Gundl., STREBEL, Beitrag Mex. Conch. v, p. 125.—TRYON, Manual i, p. 52.

Two and a half apical whorls are smooth, and the summit is less depressed than in the Mexican *Volutaxes*, the first

whorl being drawn out. The rib-striæ are arcuate, about equal to the intervals, and the columella is typically rather strongly twisted, but in some shells, probably constituting a subspecies or local variety, the twist is much less marked.

This species is somewhat related to *S. terebella* and its small form or variety *conferta*, of Jamaica; but it is very much more strongly striate, the striæ more arcuate, the spire more slender, and there are more smooth apical whorls. *S. melanielloides* is also related to *S. rectus* Pfr., of Haiti. It has a superficial resemblance to the Cuban *Pseudosubulina exilis* Pfr.

31. *S. RECTUS* (Pfeiffer). Vol. I, pl. 9, fig. 31.

Shell imperforate, subulate, rather thin, closely subarcuately plicatulate, a little glossy, waxen. Spire regularly tapering, the apex acute; suture impressed; whorls 7, rather flat, the last about one-fourth the length, rounded basally. Columella very lightly folded above. Aperture subvertical, oblong, the peristome simple, unexpanded, its margins subparallel, columellar margin somewhat calloused. Length 5, diam. 1.5, aperture 1.25 mm. long, scarcely .66 wide. (*Pfr.*).

Santo Domingo: Sierra Monte Cristi (Hjalmarson).

Bulimus rectus PFR., Malak. Bl. v, p. 152, pl. 3, f. 11, 12, 13 (1858); Monogr. vi, p. 99.—*Volutaxis rectus* STREBEL, Beitrag v, p. 125, pl. 17, f. 24.—TRYON, Man. Conch. i, p. 52.

This Santo Domingan species, Strebel remarks, belongs by its columellar structure and sculpture to *Volutaxis*. The shell is slenderly drawn out, and has very flatly convex, regularly increasing whorls. The sculpture is quite like that of *S. confertecostatus*. It measures 5.4 mm. long, with 7 whorls.

I have not seen the shell. The type figure, copied by Tryon in vol. I, is too small to show its characters satisfactorily.

32. *S. TEREBELLA* (C. B. Adams). Pl. 1, figs. 8, 10, 11.

“Shell very much elongated, regularly tapering to the summit; dingy white; with numerous transverse lightly impressed striæ; spire with rectilinear outlines; apex rather

obtuse; whorls nine and one-half, short, quite convex, with a deep suture; aperture subovate, moderately acute above; labrum thin and sharp. Mean divergence 12° ; length .3 inch; breadth .07 inch; length of aperture .052 inch." (Adams).

Jamaica:

Bulimus terebella C. B. Ad., Contrib. to Conch. no. 2, p. 28 (Oct. 1849).—REEVE, Conch. Icon. v, pl. 84, f. 620 (Dec. 1849).—PFR., Monogr. iii, p. 401.—*Opeas t.*, PFR., Nomencl. Hel. Viv. p. 322, no. 1001.

C. B. Adams' description is given above. His type, a single shell dead, but in good condition, is figured (fig. 11). It is an imperforate, subulate, turrite shell, gray-white, with the surface very weakly striate, the striae low, blunt, as wide as the intervals or wider, and perfectly even and regular. They begin in the middle of the second whorl, those above being smooth. The second whorl appears disproportionately large. The outer lip is strongly arched forward above the middle. The last whorl is somewhat compressed laterally. The cord-like columella has a weakly spiral convex fold above. Length 7.9, diam. 1.75 mm., with fully 9 whorls.

The following is a synonym, as I have satisfied myself by a careful comparison of the types.

Bulimus striatella C. B. Adams. (Pl. 1, fig. 8). Shell small, thin, glossy, diaphanous, elongate; whorls 7, convex, ornamented with robust parallel striae. Aperture wide; lip thin; columella not much twisted. Divergence 30 degrees, length .2, width .07 inch. (C. B. Ad.).

Jamaica: Pedro, St. Anns (J. S. Hyde in Adams coll.).

Bulimus striatella C. B. Ad., Synops. Conch. Jam., in Proc. Bost. Soc. of Nat. Hist. ii, 1845, p. 13.—*B. striatellus* Adams, PFR., Symbolæ iii, p. 87; Monographia ii, p. 160 (1848); not *Buliminus striatellus* Beck, *Bulimus striatellus* Pfr. 1842 (Symbolæ ii, p. 122).—*Bulimus confertus* PFR. Monogr. iv, p. 455 (1859).

Adams' type, fig. 8, is figured. Length 5.5, diam. 1.7 mm., with $7\frac{1}{3}$ whorls. It differs from *S. terebella* only in being smaller with fewer whorls, and is clearly identical

specifically. The name proposed by Adams was preoccupied, and hence the form was re-named by Pfeiffer.

Some shells are more slender than Adams' type. One before me, fig. 10, measures 5.8 x 1.5 mm., with $7\frac{1}{3}$ whorls. The striae are shown somewhat too strongly in figs. 8 and 10.

33. *S. MACROSPIRA* (C. B. Adams).

"Shell much elongated, conic; pale horn color, or brownish, with a few scattering stripes of dark brown: shining, with excessively minute distant striae: spire with the outlines a little concave above, otherwise slightly curvilinear: apex obtuse, rather small: whorls twelve, a little convex; with a well impressed suture; last whorl short: aperture ovate, rather wide: labrum thin and sharp: columella nearly straight. Mean divergence about 18° ; length .8 inch; breadth .22 inch; length of aperture .2 inch." (*Adams*).

Jamaica: Maroontown, St. James (Chitty).

Bulimus macrospira C. B. A., Contrib. to Conch. no. 9, p. 169 (April, 1851).—PFR., Monogr. iii, p. 399.—*B. macrospirus* Ad., PFR., Monogr. iv, p. 457 (new description).

The type of this species is probably in the Chitty collection in the British museum. It is not in that of Adams at Amherst. Its exact systematic position is uncertain. Dr. Pfeiffer, in his later reference to the species, described a specimen in the British Museum from Maroon Town, St. James, probably given by Chitty, and somewhat smaller than the type, length 17, diam. 5, aperture 4.5 mm., with 9 to 10 whorls.

Subgenus SIGMATAXIS Pilsbry, nov.

Glossy, translucent, pale shells, often with distant varix-stripes, the surface sculptured with longitudinal grooves. Aperture long-ovate or piriform; outer lip simple, arched forward; columella concave below, ascending in a moderate or gentle spiral. Type *S. leviusculus* Ad.

A Jamaican group of small forms, distinguished from *Volutaxis* by the longer whorls, long aperture, and smooth, grooved but never ribbed or thread-striate surface.

I have examined the type specimens of nine of the thirteen

species now known. Besides the forms herein recognized, there are several other species, represented by poor material or single specimens in the collections I have studied.

- a. Grooves widely and irregularly spaced on the last whorl or two.
 - b. Whorls 8 to 10; aperture about one-fourth the total length; 15 to 16 mm. long, 3.5 to 3.8 wide.
 - S. procerus*, no. 34.
 - bb. Whorls 9; aperture contained about $3\frac{1}{2}$ times in length; 23 x 6.6 mm.
 - S. clava*, no. 35.
 - bbb. Whorls $5\frac{1}{2}$ to 7; aperture about one-third the length; shell smaller.
 - c. Diam. less than one-third the length.
 - d. Length 5 to 7 mm.; grooves well spaced throughout.
 - S. laeviusculus*, no. 36.
 - dd. Length 5 to 7.5 mm.; grooves crowded on spire.
 - S. pauperculus*, no. 37.
 - ddd. Length 8 to 11 mm.; grooves widely spaced throughout.
 - S. perplexus*, no. 38.
 - c. Diam. more than one-third the length.
 - d. 5.3 x 1.8, apert. 2.3 mm., $5\frac{1}{2}$ whorls.
 - S. annæ*, no. 39.
 - dd. 4.75 x 1.75, apert. 2 mm.
 - S. brevis*, no. 40.
- aa. Grooves crowded and regular or nearly so on the later whorls.
 - b. Jamaican; small, about 4.5 x 1.25 or 1.3 mm., aperture about one-third the total length; very closely striate, 8 to 10 striae in a mm. on face of last whorl.
 - c. Last whorl convex.
 - S. perstriatus*, no. 41.
 - cc. Last whorl flattened, parallel-sided.
 - S. parallelus*, no. 42.
 - bb. Haitian; small, length 4.2 to 5.6 mm., aperture more than a third the length.
 - c. 4.24 x 1.4 mm. with $4\frac{3}{4}$ whorls; about 12 grooves in one mm. on face of last whorl.
 - S. unus*, no. 46.

cc. 5.6 x 2 mm., with 5 whorls; about 8 or 9 grooves in one mm. *S. verberatus*, no. 45.

bbb. Larger, 9 to 10 mm. long; 5 to 6 striae in a mm. on last whorl; Jamaica.

S. micans, no. 43; *S. calus*, no. 44.

34. *S. PROCERUS* (C. B. Adams). Pl. 3, figs. 27, 28, 29.

Shell small, glossy, thin, diaphanous, yellowish-brown, very much lengthened. Whorls 8 to 10, not very convex; lip thin; columella twisted. Divergence 18 to 14 degrees, length of spire .5 inches; total length .63, diam. .14 inch. (*Ad.*).

The shell is imperforate, thin but moderately strong, pale yellowish-corneous, a little transparent; tapering throughout, but more rapidly in the upper third of the length. The surface is brilliantly glossy, marked with longitudinal grooves at irregular intervals; adults with a few deeper grooves indicating former growth-arrest periods. First $2\frac{1}{2}$ whorls are smooth; apex obtuse. Whorls $9\frac{1}{2}$, rather weakly convex. The aperture is small, subvertical and piriform; outer lip thin, a little arched forward; basal lip somewhat retracted. Columella cord-like, concave below, spirally entering above. Length 16.6, diam. 3.8, length of aperture 4 mm.

Jamaica: Bogwalk (Johnson and Fox); Porus (Roper); Moneague (S. L. Shumo); Mandeville (Henderson and Simpson); Bellevue; Pedro, St. Ann's (J. S. Hyde in Adams coll.).

Bulimus procerus C. B. AD., Proc. Boston Soc. N. H. ii, 1845, p. 13.—*Spiraxis procera* Ad., SHUTTLEWORTH, Diagnosen n. moll. no. 6, p. 138.—*Bulimus jamaicensis* REEVE, Conch. Icon. v, species no. 503 (July, 1849), *Achatina* pl. 20, f. 113.—PFR., Monogr. iii, p. 392; iv, 453; vi, 92.—*Bulimus impressus* REEVE, Conch. Icon. v, pl. 68, f. 483 (May, 1849).—*Bulimus subula* Pfr., C. B. ADAMS, Catalogue of the Land Shells which inhabit Jamaica, Contrib. to Conch. no. 9, p. 184 (1851).—*Bulimus nitidiusculus* C. B. AD., Contrib. to Conch. no. 2, p. 27 (Oct. 1849).—PFR., Monogr. iii, p. 395.

The typical form originally described by Adams is figured (pl. 3, figs. 27, 28) and described above. Immature shells taper more rapidly and are less cylindric. There is some

variation in contour, more slender and stouter shells occurring in each colony. Thus extremes of shape in a large series from Mandeville measure:

Length 17.5, diam. 3.9, aperture 4 mm.; whorls 10.

Length 16, diam. 3.4, aperture 3.8 mm.; whorls $9\frac{1}{3}$.

Length 14.3, diam. 3.9, aperture 3.9 mm.; whorls $8\frac{1}{3}$.

A young shell from the same place is illustrated, fig. 29.

After describing this species, Adams decided that it was identical with *Bulimus subula* Pfr. (*Opeas gracile* Hutt.), and in 1851 he placed it in the synonymy of that species, a course clearly erroneous. The *B. impressus* and *B. jamaicensis* of Reeve are clearly synonyms of typical *S. procerus*. *B. nitidiusculus* of Adams is described below and figured from the unique example in his collection. It is absolutely identical with young *S. procera* of equal size.

B. nitidiusculus. Pl. 3, figs. 30, 31. Shell imperforate, oblong-turrite, thin, polished, with sculpture of irregular and widely spaced longitudinal grooves. There are 12 or 13 grooves on the last whorl, about the same number on the penult and the next earlier whorls, and none on the first two whorls. Outlines of the spire straight, the summit very obtuse. Whorls $4\frac{1}{3}$, rather weakly convex. The apex is minute, but the first whorl enlarges very rapidly, so that its last half appears abnormally large. Suture moderately impressed, with a margin by transference below. Last whorl tapering below the broadly rounded periphery. Aperture subvertical, piriform, the outer lip thin, arching forward in profile view. Columella cord-like, concave below, strongly convex and spirally entering above. Parietal callus a mere film. Length 6, diam. 2.5, length of aperture 2.8 mm.

35. *S. CLAVA* (Reeve). Pl. 3, fig. 36.

"Shell subulate, papillary at the apex, not umbilicated, whorls ten in number, smooth, polished, here and there longitudinally impressly striated, sutures margined, columella thin, but little reflected, aperture rather small, lip simple; transparent horny. The columella of this species is extremely thinly reflected, and the outer lip is rather inclined to be sinuated at the upper part." (Reve).

Habitat unknown (Mus. Cuming).

Bulimus clava REEVE, Conch. Icon. v. *Bulimus* species 500 (July, 1849), *Achatina* pl. 16, f. 77.—PFR., Monogr. iii, 398.

Pfeiffer gives the following description of the types: Shell imperforate, turrit, rather smooth, marked with distant, impressed longitudinal lines, glossy, subpellucid, tawny. Spire regularly tapering, the apex obtuse; suture lightly impressed margined. Whorls 9, flattened, the last about two-sevenths the total length, rounded basally; columella somewhat calloused, arcuate. Aperture vertical, angulate-pear-shaped; peristome simple, unexpanded, the right margin arched forward in the middle. Length 23, diam. 6.66, aperture 6.66 x 3.5 mm. (Pfr.).

The species is unknown to me, but from the description I would be disposed to think it a Jamaican snail of the subgenus *Sigmataxis*. The surface as described by Pfeiffer reminds one of the smaller *S. procera* Ad.

36. *S. LÆVIUSCULUS* (C. B. Adams). Pl. 4, figs. 43, 44.

"Shell small, thin, glossy, diaphanous, ovate, elongate. Whorls 6, not very convex, ornamented with a few distant and very narrow longitudinal striae. Aperture long, narrow and acute above; lip thin, retracted below; columella twisted. Divergence 18 degrees; spire .16 inch long. Length .25, width .075 inch [6.25 x 1.87 mm.]." (Ad.).

The shell is very slender, pale corneous, subtranslucent, thin, very glossy; sculptured with widely, unevenly spaced arcuate grooves, which are obsolete on the base and absent on the first two whorls. Two or three grooves on the last whorl are slightly deeper, and preceded by an excessively faint brownish streak. Whorls about 6, parted by a deeply impressed suture, only weakly convex. Aperture narrowly ovate, the outer lip equably arched forward, columella cord-like, concave below, ascending in a moderately strong spiral curve above. Length 6.2, diam. 1.8 mm.

Jamaica: Bogwalk (Henderson and Simpson); Braco, St. Ann's (Swift coll.).

Bulimus laeviusculus C. B. AD., Synopsis Conch. Jam., Proc.

Bost. Soc. N. H. ii, 1845, p. 13.—PFR., Monogr. ii, 159; iii, 394.

This is the senior species of a group of very closely related forms. The type lot of *B. leviusculus* in Adams' collection is mixed, containing four specimens agreeing with the diagnosis, together with four *S. pauperculus* and several other forms. From the dimensions and other characters it is clear that the shells drawn in fig. 43 and described above served as the original type. The species is very closely related to *S. pauperculus* and *S. aberrans*, but it has fewer grooves on the spire than the former, and the last whorl is perceptibly less swollen.

The specimens before me from Braco are rather small, about 4.9 x 1.5 mm., with $5\frac{1}{2}$ whorls. The narrowest seen measures 5.2 x 1.5 mm. with fully $5\frac{1}{2}$ whorls. The largest shell of a small series from Bogwalk measures 7 x 1.9 mm., aperture 2.2 mm., with $6\frac{1}{2}$ whorls; and the largest *leviusculus* seen is 7.9 x 1.9 mm., aperture 2.4 mm., with $6\frac{1}{2}$ whorls.

It is not an uncommon species, some ten lots from various sources being before me, most of them unfortunately without exact locality. The description of the synonymous *B. aberrans* Pfr. follows.

Bulimus aberrans Pfeiffer. (Pl. 4, figs. 45, 49).

Shell subulate, thin, glossy, marked with regularly distant impressed longitudinal lines; pale amber colored, sparsely ornamented with narrow, oblique reddish streaks. Spire subulate, the apex rather acute, suture lightly crenulate. Whorls 7, flattened, the last one-third the length. Columella callous, twisted-subtruncate. Aperture oblong, the peristome simple. Length 7, diam. 2, aperture 2.3 x 1 mm. Pfr.). Jamaica (Gosse in Cuming coll.).

Achatina aberrans PFR., Proc. Zool. Soc. 1845, p. 138; Monogr. ii, p. 270; Conchyl. Cab. p. 355, pl. 29, f. 20, 21.—REEVE, Conch. Icon. v, pl. 20, f. 110.—*Spiraxis aberrans* C. B. ADAMS, Contrib. to Conch. no. 6, p. 88 (March, 1850); probably of GLOYNE, Journ. de Conchyl. 1875, p. 120 (parishes of Manchester, St. Ann and St. Andrew).—*S. aberrans* var. *unicolor* C. B. ADAMS, Contrib. no. 9, p. 168 (1851).

Reeve's figure (fig. 45) seems to be poor, and is too small to show the characters clearly. Pfeiffer figured another and smaller shell from his own collection, (fig. 49), which shows the typical shape and columella of *læviusculus*. C. B. Adams' lot of *aberrans* in the Amherst collection are chiefly large *læviusculus*, but he had also *S. perstriatus* and an *Opeas goodalli* in the lot, most of the shells being in poor condition, dirty and more or less broken. He subsequently proposed to call what he took for *aberrans*, var. *unicolor*; but the absence of colored streaks seems to be due solely to the faded condition of his specimens.

37. *S. PAUPERCULUS* (C. B. Adams). Pl. 4, figs. 46, 50, 51.

"Shell much elongated, regularly tapering to the summit; white, with a thin horn colored epidermis; with numerous broad lightly impressed arcuate transverse striæ; spire with rectilinear outlines; apex rather obtuse; whorls seven, rather convex, with a well impressed suture; aperture long ovate, quite acute above; labrum thin and sharp; columella well thickened. Mean divergence 18° ; length .25 inch; breadth .25 inch; length of aperture .075 inch." (Adams).

Shell slenderly oblong-turrite, thin, pellucid, yellowish corneous, polished, with sculpture of irregularly spaced longitudinal grooves. These grooves are widely spaced on the last whorl (where there are about 10 or 11), but on the penult and next earlier whorls they are much closer by the interpolation of shorter grooves not reaching to the suture below. The first two whorls are smooth. Spire straight-sided, slender, the summit obtuse. First whorl enlarges rapidly; subsequent whorls slightly convex. Aperture small, narrow, almost lanceolate, subvertical, but receding below. Outer lip arching forward in the middle, in profile view. Columella cord-like, concave below, ascending in a convex spiral curve above. Parietal film indistinct. Length 5.2, diam. 1.6, length of aperture 1.75 mm.

Jamaica (C. B. Adams): Long Mt. and Montego Bay (Henderson and Simpson).

Bulimus pauperculus C. B. Ad., Contrib. no. 2, p. 27

(Oct., 1849).—REEVE, *Conch. Icon.* v, pl. 84, f. 624 (Dec., 1849).

The original description applies well to the form figured (fig. 46) and described above, from the only living perfect *Sigmataxis* of the type lot, except that it measures somewhat less, and has fewer whorls. There is an obvious error in Adams' measurements of this species, and probably the number of whorls is also wrongly stated by him, or counted on another shell than that measured. The type lot contains two *Opeas goodalli*, one small *Varicella* and several of the form here described as *S. pauperculus*. It is very closely related to *S. laeviusculus* Ad., but it seems to be specifically distinct by the more swollen last whorl and the closer grooves of the spire.

I figure also a typical shell from the Academy collection, probably received from Adams, and measuring 6.2 x 2 mm., with $5\frac{3}{4}$ whorls (pl. 4, fig. 51). Also a large specimen from Long mountain (Henderson coll.), measuring 7.5 x 2 mm., aperture 2.8 mm., with $6\frac{1}{2}$ whorls. There are about three pale brown streaks on each of the later several whorls (fig. 50).

Arango introduced *pauperculus* in his Cuban *Fauna* on account of an alleged identity with *B. pumilus* Pfr., which is a form or synonym of *Opeas goodalli* (see vol. XVIII, p. 202). This error was probably due to Adams' failure to discriminate between these two small forms in sending out material. His idea of *pauperculus* was evidently not clear, and included more than one species.

38. *S. PERPLEXUS* (C. B. Adams). Pl. 4, figs. 41, 42.

"Shell ovate-fusiform, much elongated; almost transparent, pale yellowish brown, with transverse, moderately curved lines of dark brown, of which the last colors the labrum, three to four on each whorl, wanting on the upper whorls, and scarcely perceptible at and above the middle of the spire; with fine not crowded transverse striæ; lines, which indicate the varices that are coincident with the brown stripes, scarcely distinguishable from the striæ; apex subacute, with nearly

one and one-half smooth whorls: spire much elongated, with the outlines moderately curvilinear: whorls about $6\frac{1}{2}$, moderately convex, with a well impressed suture: aperture long, ovate, quite narrow and acute above; columella little twisted, scarcely truncate. This species closely resembles *A. propinqua*, but the striæ are finer and more distant, and the outlines of the spire are more curvilinear. It attains about one-half of the size of that shell. Mean divergence about 21° ; length .33 inch; breadth .09 inch; length of aperture .12 inch." (*Adams*).

Jamaica.

Achatina perplexa C. B. A., Contrib. to Conch. no. 5, p. 84 (1850).—PFR. Monogr. iii, p. 492.—*Oleacina perplexa* Ad., PFR., Nomencl. Hel. Viv. 1878, p. 7, no. 36.—TRYON, Man. of Conch. i, p. 31, pl. 3, f. 27 (1885).

This species differs from *S. læviusculus* chiefly by its larger dimensions. The impressed lines or grooves are rather numerous on the spire but become irregularly and widely spaced on the last whorl. The reddish streaks become much diluted, hardly noticeable, in some specimens. There is some variation in shape among the series of nine shells in the Adams collection, as may be seen by measurements of the largest and the widest individuals:

Length 10.9, diam. 2.7, aperture 3.3 mm., whorls 7.

Length 8.2, diam. 2.5, aperture 3.1 mm., whorls 6.

39. *S. ANNÆ* Pilsbry, n. sp. Pl. 3, fig. 32.

Shell fusiform-ovate, whitish corneous with irregularly spaced streaks of pale chestnut. Surface glossy, marked with a few widely and unequally spaced longitudinal grooves; the first $2\frac{1}{4}$ whorls without grooves, apex rather obtuse. Whorls $5\frac{1}{2}$, slightly convex. Aperture acuminate ovate, the outer lip arched forward above the middle, basal margin retracted, columella cord-like, only quite weakly spiral. Length 5.35, diam. 1.8, aperture 2.35 mm.

Jamaica: St. Ann's (J. B. Henderson).

This species is much stouter in figure than *S. læviusculus* and its allies, and the early whorls are far smaller than the

young of *S. procerus*. While the three specimens may perhaps not be fully adult, yet they are referable to no described Jamaican form, which I have seen, coming nearest, perhaps, to *S. brevis* Ad.

40. *S. BREVIS* C. B. Adams.

"Shell long-ovate; pale horn color, translucent; shining, smooth anteriorly, otherwise with rather numerous microscopic striae; spire with the outlines moderately convex, with a well impressed suture; aperture ovate; labrum thin and sharp; columella with the edge moderately projected into the aperture. Mean divergence about 20° ; length .19 inch; breadth .07 inch; length of aperture .08 inch." (*Adams*).

Jamaica (*Chitty* coll.).

Spiraxis brevis C. B. A., Contrib. to Conch. no. 9, p. 168, in Ann. N. Y. Lyc. Nat. Hist. v, p. 92. (April, 1851).—*PFR.*, Monogr. iii, 471.

The type of this species was not found in the Adams collection, and is probably in that of *Chitty*. It seems distinct from the other forms by its comparatively long aperture, nearly half the length of the shell, which measures, according to *Adams*, 4.75 x 1.75 mm., aperture 2 mm.

41. *S. PERSTRIATUS* Pilsbry, n. sp. Pl. 4, figs. 47, 48.

The shell is narrowly turrite-fusiform, uniform pale corneous, somewhat translucent. Surface polished, regularly sculptured with linear vertical grooves parted by much wider flattened intervals. On the last whorl the grooves gradually weaken below the periphery and become obsolete on the base. First $1\frac{3}{4}$ whorls smooth. There are about 8 or 9 plaits in one mm. on the front of the last whorl. Apex obtuse. Whorls $5\frac{1}{2}$, convex, separated by a deep suture. Aperture very narrowly piriform, slightly oblique, the peristome being retracted below; outer lip arched forward above the middle, retracted to the upper insertion. Columella cord-like, rather strongly spiral above. Length 4.4, diam. 1.3, length of aperture 1.6 mm.

Jamaica (*Swift* coll., A. N. S.).

This delicate species resembles the smaller forms of *S. leviusculus* in shape, but differs by its very regular and close sculpture, recalling the much larger *S. micans*. There are specimens in the C. B. Adams collection at Amherst labelled *S. aberrans* var. and others from two sources in the collection of the Academy, all very similar in size, color and sculpture.

41a. *S. PERSTRIATUS* var. *ERRANS* n. var. Pl. 3, fig. 39.

The shell is excessively similar to *perstriatus*, but differs by its shorter aperture, which is wider below. It is corneous, with very pale brown streaks, two on the last and two on the penult whorl. First $1\frac{3}{4}$ whorls smooth, the rest closely and regularly grooved, the grooves arcuate, obsolete on the base of the last whorl, and about 10 in number in one mm. on the front of the last whorl. Length 3.8, diam. 1.2, length of aperture 1.4 mm.; whorls $5\frac{1}{2}$.

Haiti: Sans Souci, near Cape Haitian (J. B. Henderson).

42. *S. PARALLELUS* Pilsbry, n. sp. Pl. 4, figs. 52, 53.

The shell is very narrow, cylindric-turrite, whitish-corneous with (in the type) two very faint brownish streaks on the last whorl. Surface polished, regularly sculptured with linear, slightly arcuate grooves parted by much wider flattened intervals; the grooves obsolete on the base of the last whorl. First $2\frac{1}{4}$ whorls smooth. There are about ten plaits in a mm. on the front of the last whorl. Apex obtuse. Whorls almost 6, the earlier ones moderately convex, the last with almost straight parallel sides and convex base. Suture very deeply impressed, narrow. Aperture small, narrowly piriform, the basal margin receding. Outer lip arched forward above the middle. Columella delicate, cord-like, rather weakly sinuous. Length 4.7, diam. 1.25, length of aperture 1.6 mm.

Jamaica (A. D. Brown coll., A. N. S. P.).

Peculiar for its narrow, compressed shape, regular close grooves and piriform mouth. It is narrower than *S. perstriatus*, with a relatively smaller aperture of a different shape.

Another specimen (pl. 4, fig. 53) differs from the type by having the grooves much more widely and irregularly spaced on the last whorl, as in *S. leviusculus*. It has the other characters of *S. parallelus*, and may for the present be considered a form of that species.

43. *S. MICANS* (C. B. Adams). Pl. 3, fig. 35.

"Species similar to *A. levis*, but the shell is less elongated, the outlines of the spire are more convex, the aperture is shorter, and the columella is more twisted and not arcuate. Mean divergence 17 degrees. Length .41, breadth .115, length of aperture .12 inch." (*C. B. Ad.*).

Jamaica.

Achatina micans C. B. A., Contrib. to Conch. no. 2, p. 26 (Oct., 1849).—PERR., Monogr. iii, p. 502.—*Spiraxis micans* Chitty, Contrib. to Conch. p. 15.

There is a single specimen (fig. 35) in the Adams collection at Amherst, closely corresponding to Adams's measurements, and doubtless the type. It is subulate, pale brownish corneous, translucent, showing the white axis through. The polished surface is sculptured with close and nearly regular impressed grooves, slightly arcuate and a little more emphatic near the suture above, extending from suture to suture. On the last whorl the grooves weaken or almost fade out on the base, and on the later fourth of the whorl they are weaker and more widely spaced. There are about six striæ in the space of a mm. on the face of the last whorl. The first $2\frac{1}{4}$ whorls are smooth. The spire tapers regularly to the obtuse, rounded apex. The second whorl looks disproportionately large. Aperture slightly oblique, the outer lip receding above and below, arching forward in the middle. It has the smooth finish of an adult shell. Columella white, cord-like, moderately sinuous. Length 9.8, diam. 2.9, aperture 3 mm.; whorls $6\frac{3}{4}$.

The aperture, being slightly foreshortened in the figure, appears wider than it actually is.

44. *S. CALUS* Pilsbry, n. sp. Pl. 3, figs. 33, 34.

The shell tapers regularly, is subtranslucent, showing the

axis faintly through, milky corneous with chestnut streaks (two on the last, two on penult and four on antepenult whorl). Surface glossy, grooved (or plaited), the grooves much narrower, about one-third the width of the flattened-convex plaits, weakening below the periphery of the last whorl and obsolete at the base. There are five plaits in one mm. on the front of the last whorl (see fig. 33). Whorls $6\frac{1}{2}$, the embryonic shell of 2 whorls, the first $1\frac{3}{4}$ smooth. Suture deeply impressed. Aperture piriform, the outer lip moderately and equably arched forward in the middle. Columella moderately sinuous, appearing straight inside as seen through the last whorl. Length 9.5, diam. 2.4, aperture 3 mm. long. Whorls $6\frac{1}{2}$.

Jamaica.

Three of these shells were in the typical lot of *S. perplexus* in Adams' collection at Amherst. It is evidently related to *S. micans* but differs by the somewhat narrower contour, the more widely spaced grooves, by having colored streaks preceding the slightly deeper varix-lines, and by having only $1\frac{3}{4}$ instead of $2\frac{1}{4}$ smooth initial whorls. The difference in sculpture between *S. calus* and *S. micans* is slightly emphasized in the figures from the former being drawn to a slightly larger scale than *S. micans*.

45. *S. VERBERATUS* Pilsbry, n. sp. Pl. 1, fig. 7.

Shell long-ovate, thin, corneous, glossy, sculptured with close arcuate longitudinal grooves, obsolete at the base and wanting on the first $1\frac{3}{4}$ whorls. There are about 8 or 9 striae in the space of a mm. on the face of the last whorl, but they become closer on the back of the whorl. Whorls 5, quite convex below the suture, less so elsewhere. Aperture long-ovate; outer lip arched forward. Columella vertical, a little excised near the base, but seen to be weakly sinuous within the last whorl in broken shells.

Length 5.6, diam. 2, length of aperture 2.75 mm.

Haiti: Port au Prince (J. B. Henderson).

The very weakly spiral columella is characteristic of this species and the next. It is only by looking through the last

whorl, when it is sufficiently transparent, or by observing broken shells, that the spiral trend of the axis becomes appreciable.

46. *S. UNUS* Pilsbry, n. sp. Pl. 3, fig. 40.

Shell very thin, clear corneous, glossy, with even, regular and close sculpture of arcuate longitudinal grooves separated by flat intervals, about 12 in the space of 1 mm. on the front of the last whorl. First $1\frac{1}{2}$ whorls smooth. Whorls $4\frac{3}{4}$, strongly convex just below the deeply cut suture, but elsewhere flattened. Aperture narrowly piriform; outer lip arched forward in the middle. Columella very short and vertical as seen from in front, but somewhat convex in the middle in oblique view; sinuous as seen through the shell. Length 4.24, diam. 1.4, length of aperture 1.8 mm.

Haiti: Thomazeau (J. B. Henderson).

The unique example of this species is smaller and more slender than *S. verberatus*, but with about the same number of whorls. The sculpture is similar but finer.

Subgenus GLANDINELLA Pfeiffer.

Glandinella PFR., Nomenclator Heliceorum Viventium p. 328, 1878, for *B. poeyanus*.

Shell imperforate, subulate-turrite, composed of about 8 rather rapidly widening whorls. First $1\frac{1}{2}$ whorls smooth, the next whorl delicately closely striate, the rest of the whorls sculptured with spaced riblets and marked with dark varix-streaks. Aperture long-piriform, its length fully twice the width; outer lip simple, arched forward; columella concave below, ascending in a long weak spiral. Soft anatomy unknown.

Distribution, Isle of Pines. Type *S. poeyanus*.

The embryonic shell (pl. 3, fig. 38) seems to be composed of $2\frac{1}{2}$ whorls. The first $1\frac{1}{2}$ are smooth, and increase very rapidly; then the width of the whorl from suture to suture decreases slightly, and close, fine, vertical striae begin. This stage continues three-fourths of a whorl, and there abruptly

gives place to the neanic stage, with adult sculpture of riblets separated by spaces of about double their width.

In the general shape and the columella *Glandinella* is like the Jamaican group *Sigmataxis*, but it differs in the system of sculpture. The long aperture and colored streaks are features unlike *Volutaxis*.

47. *S. POEYANUS* (Pfeiffer). Pl. 3, figs. 37, 38.

Shell imperforate, subulate, thin, subarcuately plicate, but little shining, diaphanous, pale corneous, irregularly marked with somewhat varix-like reddish streaks. Spire long, slender, the apex rather acute, suture impressed. Whorls 8, slightly convex, the last about one-third the total length, slightly tapering basally. Columella callous, somewhat twisted, obliquely receding. Aperture oblique, oblong-oval; peristome simple, the margins joined by a thin callus, right margin reddish bordered, arched forward above the middle, somewhat bent in. Length 12, diam. 3, aperture 4 x 1.75 mm. (*Pfr.*).

Isle of Pines (Gundlach).

Bulimus poeyanus PFR., Malak. Bl. i, 1854, p. 157; ii, p. 156 (*Opeas*); Monographia iv, 458; vi, 97.—*Spiraxis* (*Glandinella*) *poeyanus* PFR., Nomencl. Hel. Viv. p. 328, no. 970 (1878).—*Glandinella poeyana* CROSSE, Journ. de Conch. 1890, p. 248.—*Bulimus Bayanus* (error for *poeyanus*) PFR., Malak. Bl. i, 1854, pl. 3, f. 1-3.—*Achatina* (*Glandina* ?) *pazensis* PEREZ ARCAS, Journ. de Conchyl. vi, 1857, p. 282, pl. 10, f. 8, 9.—*Glandina pacensis* Perez, MARTENS in Albers, Die Hel., p. 30.

The glossy surface is sculptured with sinuous riblets about half as wide as their intervals. The brown streaks lie parallel to the riblets, and usually there are about 4 or 5 on the last whorl, 2 to 4 on earlier whorls. The columella is nearly straight, but when viewed obliquely a slow spiral twist may be noticed. There is no trace of basal truncation. The species has no close relatives. The specimen figured measures, length 11.5, diam. 3, length of aperture 3.8 mm., with $8\frac{1}{3}$ whorls.

Subgenus BIANGULAXIS nov.

The shell is oblong-turrite, smooth and glossy, pale, composed of 8 whorls, the upper ones plicate at the suture. Aperture narrowly semioval; columella somewhat truncate at base, with an oblique fold above. Type *S. moreletiana* Pfr.

The single species is apparently still known by one specimen only. It was described as a *Spiraxis*, and subsequently referred to *Streptostyla* by Pfeiffer, followed by Tryon and Crosse, but it seems, so far as one can judge by the description and figure, to stand nearer the present group. The structure of the columella is not very unlike that of *S. inusitatus*. Were it not from an inland locality, I would be disposed to think it an *Auriculastrum*. Pfeiffer alludes to its *Ferussacia*-like aspect.

48. *S. MORELETIANUS* Pfr. Vol. I, p. 49. Banao, Cuba.

Genus VARICELLA Pfeiffer, 1855.

Varicella PFR., Malak. Bl. ii, 1855, p. 172, for *Achatina leucozonias*, *dominicensis*, *procera*, *griffithsi*, *ligata*, *jamaicensis*, *philippiana*, *venusta*, *nemorensis*, *similis*, *costulosa* and *nitida*.—ALBERS-MARTENS, Die Heliceen, 1860, p. 30, type *leucozonias*.—*Melia* Albers, Die Heliceen, 1850, p. 195, for *phillipsii*, *griffithsi* and *venusta*. Not *Melia* Billb. 1820 (Crustacea) or of Desv. 1830 (Diptera).—*Achatina*, *Glandina* and *Oleacina* of some authors.

Oleacinidæ with the post-nepionic whorls of the oblong or turrite shell sculptured with occasional varices or varix-lines, more or less conspicuously differentiated from the other sculpture, and often preceded by dark streaks. Embryonic shell of 2 to $3\frac{1}{2}$ whorls, smooth or ribbed. Aperture less than half the total length, the outer lip narrowly expanded or simple, columella more or less strongly truncate at the base.

Type *V. leucozonias*. Distribution, Antilles, except perhaps some of the Caribbean islands; southern Florida.

Very little is known of the soft anatomy of this genus. Binney has figured the teeth of *V. semitarum* and *V. phillipsi*. The former has 30, 1, 30 teeth, with a very well developed cen-

tral, not greatly smaller than the adjacent lateral teeth (pl. 25, fig. 2). The teeth of *V. phillipsi* are said to be similar.

No sharp lines can be drawn between the three groups of large *Oleacinidae* here treated as genera, *Varicella*, *Oleacina* and *Euglandina*, at least with our present very imperfect knowledge of the anatomy of the first two; yet there is little difficulty in assigning the species to one or other of them. In *Varicella* the spire is usually more lengthened, the aperture shorter than in the other two groups, and the varices or varix-lines are invariably present, whereas in *Oleacina* and *Euglandina*, they are only rarely developed distinctly. I have elsewhere alluded to the affinities of *Varicella* and *Spiraxis*.

The distribution of the forms indicates an early segregation of the ancestral stock into three phyla. One of these, *Euglandina*, was evolved upon the mainland with southern Mexico as the probable center of radiation. *Oleacina* had its rise in the Haiti and East Cuba tract. The third, *Varicella*, apparently arose in Jamaica, with an early radiation into the Haiti-Cuban area.

Varicella consists of a considerable number of derivative phyla largely expressed in the degree to which the sculpture has been modified and accelerated. In the more primitive form the embryonic whorls are smooth, as in *Oleacina*, *Euglandina*, *Spiraxis*, etc., but in more or less divergent members of this stock there was a tendency towards earlier appearance of the sculpture (aside from the varices), producing several independent collateral phyla with sculptured embryonic shells, such as *Pichardiella*, *Varicellaria*, *Varicellopsis*, etc. In both Haiti and Jamaica these groups arose; elsewhere the primitive smooth embryo was not modified.

The subgenus *Pichardiella* is perhaps the most distinctly divergent group in the genus, and its wide distribution probably indicates that it was evolved before the separation of Haiti-Cuba and Jamaica. It is noteworthy that this is the only Varicelloid group which has reached West Cuba. In treating of the *Urocoptidae* I have had occasion to show that the snail fauna of West Cuba was largely evolved independently of East Cuba, indicating separation of the two areas

throughout a considerable portion of Tertiary time. The wide distribution of the single species *V. gracillima* is not readily explicable at present. It belongs in a class with numerous other minute shells, *Opeas*, *Thysanophora*, *Pseudohyalina*, *Bifidaria*, etc., which have been widely spread by some such unusual means of transport as tornados, which might carry them, together with the dry leaves, etc. among which they live, for long distances.

Of the 75 species of this genus now known, 28 were briefly described and figured by Tryon in vol. I of this work. The small and slender forms were at that time thought to belong to the Stenogyroid group of Achatinidæ. In my study of the species omitted from Tryon's account, I found it necessary to examine the whole series, and to study the types of a large number of them in the Adams collection at Amherst; and it was deemed best to give here the results of my studies upon the species included in vol. I. together with the others, restricting the account to new matter and figures, essential to the proper identification of the forms, and not duplicating information given in Tryon's monograph.

Very little is known of the detailed distribution of the Jamaican species. Prof. C. B. Adams, who personally collected many of them, was satisfied to label his specimens "Jamaica," and all record of the type localities is lost, except in a few cases. The few records made by later authors are not always trustworthy, since no adequate means existed for the exact determination of their specimens. I have been enabled to supply data on many species from the collections of Mr. J. B. Henderson of Washington, generously placed at my disposal.

Key to Subgenera and Sections of Varicella.

- I. Neanic and adult sculpture of spaced ribs with much finer striæ in the intervals, and with occasional varices; sometimes also striate spirally. Embryonic shell pupiform or cylindric, of $2\frac{1}{3}$ to $3\frac{1}{2}$ long whorls, vertically striate except the first whorl or half whorl. Columella truncate or almost simple. Shell small and slender.

Subgenus PICHARDIELLA, p. 50.

II. Sculpture of subequal striæ or riblets, with the usual varices.

a. Spiral lines or grooves well developed on the later whorls; varices and outer lip nearly straight, not arched forward or angular; rather large shells of Haiti.

b. Later whorls evenly rib-striate, with impressed spiral lines; spire rather short; embryonic shell of $3\frac{1}{3}$ whorls, closely striate except the first $\frac{3}{4}$ whorls.

Section *Varicellidea*.

*b*¹. Later whorls with close, irregular folds and spiral sulci, irregularly pitted; spire long; apex unknown.

Section *Varicellopsis*.

*a*¹. Not perceptibly striate spirally.

b. First $\frac{1}{2}$ to $1\frac{1}{2}$ of the embryonic whorls smooth, the rest striate or ribbed, Jamaican forms.

c. Columella straightened, very weakly, obliquely truncate; shell slender.

Section *Varicellula*.

*c*¹. Columella strongly twisted, conspicuously truncate; shell of moderate or rather large size, sculptured with riblets or rib-striæ, the intervals as wide as the riblets; outer lip arcuate or angular.

Section *Varicellaria*.

*c*². Columella strongly twisted and truncate; $2\frac{1}{2}$ embryonic whorls, the first $1\frac{1}{2}$ smooth, the next with widely spaced grooves; adult sculpture of sinuous rib-striæ wider than the intervening grooves; outer lip arcuate. No colored varix-streaks.

Section *Varicellina*.

*b*¹. First $2\frac{1}{3}$ to 3 whorls smooth.

c. Later whorls with sculpture of even striæ between the varices, the striæ wider than their interstices, or with irregularly spaced grooves.

Section *Varicella*.

*c*¹. Later whorls without grooves or striæ be-

tween the varices, polished or with faint growth-riblets only; columella strongly concave. Porto Rico, Lesser Antilles.

Section *Lævaricella*.

Subgenus PICHARDIELLA Fischer.

Melaniella PFR., Monographia Heliceorum Viventium iv, p. 465 (1859), for *Bul. acuticostatus*, *manzanillensis* and *gracillimus*.—MARTENS in Albers, Die Heliceen, 1860, p. 267. Not *Melanella* Bowdich, Elements of Conchology, 1822.—*Pichardiella* FISCHER, Journ. de Conchyl. 1887, p. 200, proposed as a substitute for *Melaniella* Pfr.; *B. pichardi* and *B. acuticostatus* mentioned.

Small, slender Varicellas with low sigmoid varices and higher longitudinal ribs, which are narrower than their distinctly striate intervals; the pupiform or subcylindric embryonic shell is striate, composed of $2\frac{1}{2}$ to $3\frac{1}{2}$ long whorls, with exserted summit. Columella arcuate or straight, ranging from distinctly truncate to nearly entire at the base. Radula with well developed central teeth, all the teeth very minute and not varying much in size.

Type *V. pichardi*. Distribution, Antilles, south Florida.

This group although hitherto associated with the Stenogyroid snails, is essentially Varicelloid, having the periodic varices, coloration and dentition of that genus. It differs from other subgenera of *Varicella* by (1) the sculpture of spaced ribs with interstitial striæ, (2) the exserted, narrow embryonic shell, and (3) the oblique or very weak truncation of the columella.

In one species, *V. lioderma*, striæ are wanting between the ribs of the surface.

These snails live on the ground, usually under or on stones and rubbish. They rarely if ever occur in large numbers and are usually solitary.

Melaniella brevicula H. Ad., P. Z. S. 1870, p. 379, is an error for *Melania* (*Melanella*) *brevicula*.

V. (Pichardiella) mandevillensis (pl. 25, fig. 1) has 14, 1, 14 teeth in slightly oblique transverse rows. The central tooth is well developed; the side teeth are of typically Oleacinoid

form, and decrease in size very slowly towards the edges of the radula. The teeth are excessively minute, far smaller than in any other Oleacinidæ I have examined. The slight obliquity of the transverse rows contrasts with other known forms, in which they are as a rule strongly oblique.

The species are distributed as follows:

Cuba, species 1 to 7.

Southern Florida, species 3a.

St. Thomas, species 3b.

Haiti, species 8.

Jamaica, species 9 to 17.

Trinidad (?) species 18.

Panama (?) species 19.

Keys to the Cuban (p. 51) and the Jamaican species (p. 62) will be found in the text.

Cuban species.

The east Cuban species *scalarina*, *tuberculata* and *multicosta* are not known to me by specimens; the descriptions and figures are crude; therefore no satisfactory key to species can yet be framed.

I. Surface distinctly striate spirally; usually with dark streaks.

a. Ribs angular or spinose at the shoulder; shell with streaks.

b. East Cuba; closely striate, with remote ribs; 8.3 x 2.6 mm., whorls 7.

V. tuberculata, no. 6.

b¹. W. Cuba; ribs produced in hollow spines at the shoulder, obsolete or wanting at the base; intercostal reticulation weak; 12.8 x 4 mm.

V. a. horrida, no. 1b.

b². Short spines at shoulder and smaller ones below periphery, more slender, 8½ whorls.

V. acuticostata, no. 1.

b³. Last whorl less distinctly biangular, with only weak traces of spines, 13 to 16 waved striæ in each interval; 13.8 x 3.6 mm., with 10 whorls.

V. a. filipensis, no. 1a.

- a*¹. Ribs unarmed, 13 to 15 on last whorl, intervals with 18-20 fine striæ and spiral lines; reddish-brown, not streaked; 12 x 3 mm. with 9 whorls; W. Cuba.

V. pichardi, no. 2.

- II. Surface not spirally striate, though sometimes the longitudinal striæ are a little waved; corneous or pale brown, not streaked.

a. East Cuban forms.

- b*. 14 low compressed ribs on last whorl; 6 x 1.75 mm. with 8 whorls. *V. scalarina*, no. 5.

- b*¹. Elevated, cord-like ribs; 9.5 x 2 mm., with 10 whorls. *V. multicosta*, no. 7.

- a*¹. Middle and west Cuban forms, etc.; columella not truncate or very indistinctly so.

- b*. Axis gyrate, a central false umbilicus visible from the base; very slender, 6 x 1.6 to 7 x 1.75 mm., 7 or 8 whorls.

- c*. About 20 ribs on last whorl, 4 to 5 striæ in each interval. *V. gracillima*, no. 3.

- c*¹. 9 to 12 striæ in each interval.

V. g. sanctithomensis, no. 3b.

- c*². About 25 ribs on last whorl, 6 to 8 striæ in each interval.

V. g. floridana, no. 3a.

- b*¹. Axis straight, no central hole visible from the base; shell less slender, diam. 2 mm. or more.

- c*. 20 to 21 smooth ribs on last whorl, 8 to 11 striæ in each interval; 8 to 9.5 mm. long.

V. manzanillensis, no. 4.

- c*¹. 16 to 18 ribs on last whorl, 10 striæ in each interval; 6 to 7 mm. long.

V. m. cienfuegosensis, no. 4b.

- c*². 24 to 29 ill-developed ribs on last whorl, 5 to 7 striæ in each interval, 8 to 9 mm. long.

V. m. trinitatis, no. 4a.

1. *V. ACUTICOSTATA* (Orbigny). Pl. 15, figs. 1, 10.

Shell tapering, turrit, attenuate near the summit, thin,

pale brown with occasional purple-brown streaks. Surface lusterless, sculptured with compressed ribs, which bear flattened projections or short spines at the shoulder, smaller ones at the lower angle of the whorls. There are about 12 ribs on the last whorl, exclusive of one or two lower sigmoid varices. Surface between the ribs is delicately, in part subobsoletely, striate vertically, and bears numerous spiral threads, separated by wider spaces. Whorls $8\frac{1}{2}$, the first half whorl smooth, next $2\frac{1}{2}$ whorls of the embryonic shell delicately striate vertically. The last embryonic whorl has a diameter of fully 1 mm. Suture deeply impressed. Last whorl obtusely biangular, flat or concave between the angles. Aperture oblique, piriform, yellowish within; outer lip sinuous and slightly expanded; columella vertical, receding at the base, white. Length 10, diam. 3.25, length of aperture 3 mm.

Western Cuba: Organ Mts., at Rangel, Sumidero, Jaruco (Arango), and Camoa (Cisneros).

Bulimus acuticostatus ORB., Historia Fis. Polit. y Nat. de Cuba, Moluscos, p. 93, pl. 11 *bis*, f. 16-18 (1845); French edit. i, p. 175.—PFR., Monogr. ii, p. 157; iii, 394; iv, 464; vi, 103; Novit. Conch. p. 426, pl. 96, f. 15-17 (var. *horrida*), and f. 18-20 (var. *filipensis*).—GUNDLACH, Malak. Bl. iv, 1857, p. 43.—*Melaniella a.*, ARANGO, Fauna p. 87.—CROSSE, Journ. de Conch. 1890, p. 249.

Animal whitish, but rust-colored dots give the body a mixed or sprinkled color; tentacles and a lateral band from each, rust-brown. In creeping, 5 to 6 waves are seen along the foot. It occurs everywhere in the Organ Mountains, on cliffs and stones, sometimes on trees, never numerous but always solitary (Gundlach, Malak. Bl. iv, 43).

Typical specimens, described above and figured (fig. 10) have been taken by Arango at Cerro de Cabras. They agree exactly with Orbigny's description and figure (fig. 1) of specimens from "the interior of Cuba," without exact locality. His type measured 12 x 3 mm., with 9 whorls. The intercostal vertical striation is irregularly developed, mostly weak, about as in var. *horrida*.

The distribution of the species as above given (after Arango) many include some varieties also. The only typical *acuticostata* I have seen with exact locality are from Cerro de Cabras. I do not know what forms occur at the other places mentioned by Arango.

1a. Var. *filipensis* Pils., n. v. Pl. 15, fig. 4.

Shell more lengthened than *acuticostata*, the whorls less distinctly biangular; ribs lower and more slender, with only weak traces of spines or projections. There are 13 to 16 fine, waved striae in each intercostal space on the last whorl. Pale brown with a few broad dark brown streaks. Length 13.8, diam. 3.6, aperture 4 mm.; whorls 10.

Los Cayos de San Filipe, in Pinar del Rio province.

This variety is a transition to *V. pichardi*, from which it differs in being more robust and dark-streaked.

1b. Var. *horrida* Pils., n. v. Pl. 15, figs. 2, 3.

Ribs produced into inflated hollow spines at the shoulder, longer than in *acuticostata*, and often broken; *on the base of the shell the ribs are very weak or wanting*. Interstitial reticulation is sparse and open, the longitudinal striae few, 8 to 12 in each space, unequal and in part very weak. Light brown, uniform or with some dark maculation.

Length 12.8, diam. 4, aperture 4 mm.; whorls $8\frac{1}{2}$.

Length 12.5, diam. 3.9, aperture 4 mm.; whorls $8\frac{1}{2}$.

Pozas, prov. Pinar del Rio (Wright).

2. *V. PICHARDI* (Arango). Pl. 15, fig. 9.

Shell imperforate, fusiform-subulate, thin, brown-reddish, longitudinally and transversely striate, and excepting the first 3 whorls, having strong transverse ribs alternating with some weaker ones. Spire long, the apex acute. Whorls 9, slightly convex, the last one-fourth the total length, tapering at base; suture deep. Aperture subrhombic-oval; peristome thin, unexpanded, the margins joined by a callus, right margin arched forward, columellar margin somewhat straightened. Length 12, diam. 3, aperture 2.75 mm. (*Arango*).

Western Cuba: Guane and Paso Real, on stones (*Arango*).

Bulimus (*Melaniella*) *pichardi* ARANGO, Journ. de Conch. 1862, p. 409.—PFR., Monogr. vi, 103; Novit. Conch. p. 427, pl. 96, f. 21-23.—*Melaniella pichardi* Ar., CROSSE, Journ. de Conchyl. 1869, p. 21, pl. 1, f. 5; J. de C. 1890, p. 249.

“Similar to the nearly unarmed variety of *acuticostata* [var. *filipensis*], but it differs by the entirely unarmed ribs, and by having the whorls flattened [like a narrow shelf] below the suture, not sloping up to it as in *acuticostata*. The color also is darker. It differs from *tuberculata* Gundl. by the unarmed ribs and more numerous longitudinal [spiral] lines. It is larger than *gracillima* and *manzanillensis*, and has longitudinal [spiral] lines.” (*Arango*).

A typical specimen is figured, length 12, diam. 3, aperture 3.2 mm., with 9 whorls, the first 3 embryonic, delicately striate as in *V. acuticostata*. The later whorls are quite convex and peculiarly turned in just below the suture, elsewhere flattened. There are about 13 to 15 vertical ribs on the last whorl, besides two or sometimes three sigmoid varices. In each interval there are about 18 to 20 very fine striæ parallel to the ribs, but crinkled where they pass over the low spiral cords. The aperture is like that of *acuticostata* or a little more narrowly piriform.

In the very closely related *V. a. filipensis*, there are weak traces of nodes or spines on the ribs; the shell is larger with dark streaks behind the varices, and there are not so many intercostal striæ.

V. pichardi, *V. a. filipensis*, *V. acuticostata* and *V. a. horrida* form a series of progressively more strongly sculptured forms, which will probably prove to belong to one species.

3. *V. GRACILLIMA* (Pfeiffer). Pl. 14, figs. 26, 29, 30.

Shell imperforate, subulate, thin, sculptured with nearly straight longitudinal ribs and very close parallel lines in the intervals of the ribs; pale corneous-whitish; suture impressed. Whorls 7 to 8, flattened, the last slightly more than one-fourth the total length, obtusely angular below the middle. Columella subsimple, forming an angle at the base of the aperture. Aperture oval-subtriangular; peristome simple,

the right margin impressed outside, spreading, columellar margin shortly reflexed, appressed. Length 7, diam. 1.75, aperture 2 x 1 mm. (*Pfr.*).

Western Cuba: Carmelo, near Havana (Rhoads); Lagunillas district of San Juan y Martinez, Prov. Pinar del Rio (Wright); Managua (Poey); Matanzas and near Sancti Spiritus, Santa Clara province (Pilsbry). Varieties in St. Thomas and South Florida.

Achatina gracillima PFR., in Wiegmann's Archiv f. Naturg. 1839, p. 352.—*Bulimus g.*, PFR. Symbolæ iii, p. 54; Monogr. ii, 160; iii, 394; iv, 465; vi, 105.—REEVE, Conch. Icon. v, pl. 80, f. 594.—*Melaniella g.*, ARANGO, Fauna Malac. Cubana p. 88.—*Bulimus striaticostatus* ORB., Hist. Fis., Polit. y Nat. de la Isla de Cuba, Moluscos, p. 93, pl. 11 bis, f. 19-21 (1845); and French edition i, p. 176 (*B. striaticostata*).

Pfeiffer's specimens were collected either in Havana or Matanzas provinces, but he does not give the exact place. I have taken Matanzas to be the type locality, since Pfeiffer collected extensively there. Specimens are before me from all the places mentioned above except Managua.

A Matanzas shell (pl. 14, fig. 26) measures, length 6, diam. 1.6, aperture 1.7 mm., with $7\frac{3}{4}$ whorls. There are $2\frac{1}{2}$ whorls in the subcylindric embryonic shell, the first half whorl smooth, next whorl rather coarsely costulate, the following embryonic whorls more closely and finely costulate, the intervals smooth. This sculpture is rather abruptly replaced by the spaced ribs and striate intervals of the neanic stage. The last whorl has about 20 (19 to 22) narrow ribs, each interval sculptured with 4 or 5 striae. I see no trace of spiral striation. There are also several sinuous varices on the later whorls, at intervals of a half-whorl or more. The aperture is quite oblique, piriform; outer lip bent in and produced forward at its upper third. Columella very indistinctly subtruncate at base, broadly concave above, continued as a curved callous ridge on the parietal callus. Parietal callus appressed, but with a distinct thread-like or thickened edge connecting the lip-ends. In a basal view the axis is seen to revolve around a central well or "false umbilicus" as shown in pl. 14, fig. 32.

The form from near Sancti Spiritus is shorter, 5 mm. long, with $7\frac{1}{2}$ whorls.

Orbigny's *B. striaticostatus* (pl. 14, figs. 29, 30) is identical with *gracillima*, and doubtless came from the same district. The type measured 5 x 1.25 mm. Poey mentions *Stenogyra ejuncida* Shuttl. as a synonym (Memorias, p. 396). It was never published.

3a. Var. *floridana* Pilsbry, n. v.

Last whorl with about 25 ribs, the intervals with 6 to 8 striæ; otherwise like Cuban *gracillima*. Length 6.1, diam. 1.5 mm., with 8 whorls.

Florida: Key West (Hemphill); Big Pine Key (Brown and Fowler, 1904); Miami and Arch Creek, 12 miles northward (S. N. Rhoads).

Achatina gracillima BINNEY, Terr. Moll. ii, p. 293, pl. 53, f. 3.—*Stenogyra g.*, W. G. BINN., Land and Fresh-water Shells i, p. 232; Terr. Moll. v, p. 195; Man. Amer. Land Shells, 1885, p. 426, fig. 474.—*Opeas gracillima* RHOADS, Nautilus xiii, p. 46.—*Melaniella gracillima floridana* PILSBRY, Nautilus xix, p. 40, Aug. 1905, no description.

Fresh shells are brown, not drab as stated by Binney.

3b. Var. *sanctithomensis* Pilsbry, n. v. Pl. 14, fig. 32.

Shell ribbed about as in the Cuban form, but with much finer, closely crowded striæ between the ribs, 9 to 12 in each interval. Otherwise similar to *V. gracillima*.

St. Thomas, hill opposite Baker's, under stones among fine earth (Bland, Swift).

Bulimus sp. undet., BLAND in Adams' Contrib. to Conch. no. 11, p. 222 (1852).

I have seen numerous specimens of this form. It has much finer, more even and numerous interstitial striæ than either the Cuban or Floridian shells. The base only is illustrated.

4. *V. MANZANILLENSIS* ('Gundl.' Pfr.). Pl. 15, fig. 11.

Shell imperforate, fusiform-subulate, thin, closely striate

and subarcuately ribbed; pale corneous. Spire elongate, the apex acute. Whorls $8\frac{1}{2}$, slightly convex, the last slightly over one-fourth the total length, tapering at base. Aperture oblique, subrhombic-oval; peristome simple, unexpanded, the margins joined by a callus; right margin spreading forward, columellar margin somewhat straightened, forming an indistinct angle with the slightly effuse basal lip. Length 8.33, diam. 2.25, aperture 2.5×1.25 mm. (*Pfr.*).

Eastern Cuba: Manzanillo (Gundlach type loc.); Cabo Cruz and Trinidad (Gundlach, according to Arango); Sagua de Tánamo (Arango).

Bulimus manzanillensis Gundlach, *Pfr. Malak. Bl.* iv, 1857, p. 172.—*Pfr.*, *Monogr.* iv, 465; *Novit. Conch.* p. 428, pl. 96, f. 24-26.—*Melaniella m.*, *Arango, Fauna*, p. 88.

I have not seen Manzanillo or other East Cuban specimens. Pfeiffer does not mention spiral striæ, but his figure in the *Novitates Conchologicae* shows them. The forms which I collected in Central Cuba are referred to the species with some doubt, on account of this uncertainty about the finer details of sculpture.

Form from Sancti Spiritus, pl. 14, fig. 23. About 2 or 3 kilometers northeast of Sancti Spiritus, among white limestone rocks which rise conspicuously above the plain and are locally known as the rocks of San José, I found the form figured, which seems to be close to typical *manzanillensis*. It varies remarkably in contour, specimens measuring:

Length 9.3, diam. 2.5, aperture 2.7 mm.; whorls $8\frac{3}{4}$.

Length 8.1, diam. 2.75, aperture 2.8 mm.; whorls $7\frac{3}{4}$.

Length 8.5, diam. 2.1, aperture 2.25 mm.; whorls $8\frac{1}{2}$.

Length 9.5, diam. 2.6, aperture 2.8 mm.; whorls $8\frac{3}{4}$.

There are about 20 or 21 smooth narrow vertical riblets on the last whorl, about the same in stout and slender shells, and one or two sigmoid varices. Each interval bears about 8 to 11 low striæ, wider than their interstices. The striæ appear nearly smooth, but in places they are slightly waved, giving an effect in certain lights and under a low power lens, of spiral sculpture. Under higher magnification this appearance is largely lost. The embryonic whorls are sculptured

about as in *V. acuticostata*. The remaining whorls are very convex just below the sutures, elsewhere flattened. The outer lip retracts somewhat to the upper insertion. Columella vertical, not perceptibly truncate at the base. The internal axis is slender and straight. The shell is of a uniform light brown color.

4a. Var. *trinitatis* Pilsbry, n. v. Pl. 14, fig. 24.

Size and shape about as in the preceding form, but the ribs are more numerous and less prominent, sometimes so reduced on the last whorl as to be difficult to count; 24 to 29 ribs and two varices on the last whorl, 5 to 7 striae in each interval. There is the same elusive appearance of spiral striation noted above in *Sancti Spiritus* shells.

Among rocks on the steep N.-W. side of La Vigia at Trinidad (Pilsbry, 1904).

4b. Var. *cienfuegensis* Pilsbry, n. v. Pl. 14, fig. 25.

Smaller than any other described form of *manzanillensis*; whitish-corneous, somewhat glossy. There are 16 to 18 well-developed, smooth, narrow ribs and two sigmoid varices on the last whorl, usually with about 10 striae in each interval.

Length 6.9, diam. 2, aperture 2.1 mm.; whorls $8\frac{1}{2}$.

Length 6.3, diam. 2, aperture 2 mm.; whorls $7\frac{1}{2}$.

Near Cienfuegos, at a place called Lagunilla (Pilsbry, 1904).

Smaller than other races of *V. manzanillensis* but much more robust than any form of *V. gracillima*, and further distinguished by the straight columella.

5. *V. SCALARINA* ('Gundl.' Pfr.). Pl. 15, fig. 8.

Shell imperforate, subfusiform-turrite, thin, diaphanous, pale corneous; smooth, sculptured with compressed, equidistant, but little elevated ribs, about 14 on the last whorl. Spire turrite, the apex acute; suture deep; whorls 8, convex, the last somewhat tapering basally, about one-fourth the total length. Aperture oblique, subrhombic-oval; peristome simple, the right margin somewhat sinuous, columellar

margin receding, somewhat calloused. Length 6, diam. 1.75, aperture 1.5 mm. long. (*Pfr.*).

Eastern Cuba: Yunque de Baracoa, type loc.; Monte Toro (Gundlach).

Bulimus scalarinus Gundl. mss., PFR., Malak. Bl. xiii, 1866, p. 59; Monogr. vi, 104; Novit. Conch. p. 428, pl. 96, f. 27-29.

—*Melaniella scalarina* Gundl., ARANGO, Fauna, p. 88.

I have not seen this species.

6. V. TUBERCULATA ('Gundl.' Poey.). Pl. 15, fig. 5.

Shell imperforate, oblong-turrite, rather thin, longitudinally very closely striate, decussated with spiral striæ, and sculptured with remote ribs; corneous, irregularly marked with chestnut streaks. Spire turrite, the summit rather acute. Whorls 7, angular above the middle, the last not one-third the total length, tapering basally, lightly striatulate anteriorly. Columella receding, somewhat calloused; aperture a little oblique, semioval, acute above, obsoletely angular at the base; peristome simple, unexpanded. Length 8.33, diam. 2.66, aperture 2.5 mm. long. (*Pfr.*).

Eastern Cuba: Guantánamo (Gundlach); Buenavista, in Bayamo jurisdiction; Loma del Gato, Santiago (Gundlach).

Melaniella tuberculata Gundl., POEY, Memorias ii, p. 7, no. 398; p. 67, pl. 7, f. 10, 11 (1858).—ARANGO, Fauna, p. 88. —*Bulimus* t., Gundl., PFR. Malak. Bl. ix, 1862, p. 133; Monogr. vi, 104; Novit. Conch. p. 429, pl. 96, f. 30-32.

I have not seen this species. It was mentioned in Poey's *Memorias*, with a very rude figure of the living animal and the last whorl of the shell; but it was not described until some years later. A good account of the species is still lacking.

7. V. MULTICOSTA ('Gundl.' Pfr.).

Shell imperforate, turrite, rather thin, closely sculptured with elevated cord-like longitudinal riblets; corneous-whitish. Spire subulate, the vertex acute; suture impressed, denticulate. Whorls 10, rather flat, the last scarcely one-fourth the total length, rounded basally. Aperture oblique, subtrian-

gular-oval; peristome simple; columellar margin somewhat calloused, appressed. Length 9.5, diam. 2, aperture 2 mm. long. (*Pfr.*).

Eastern Cuba: Yunque de Baracoa (Gundlach), on moss-covered trees and rocks.

Bulimus multicosta Gundl. mss., *Pfr.*, Malak. Bl. xiii, p. 866, p. 58; Monogr. vi, 104. — *Melaniella multieosta* (sic) ARANGO, Fauna, p. 88.

Haitian Species.

8. *V. INOPINATA* Pilsbry, n. sp. Pl. 15, figs. 6, 7.

This species is known by three incomplete individuals: a young shell of 5 whorls, 3 mm. long (fig. 6), a nearly adult shell which has lost the early whorls, the part remaining 6 mm. long, 2.1 wide (fig. 7), and an immature shell of $6\frac{1}{2}$ whorls, 4.7 mm. long.

The first half whorl is smooth; next whorl set with straight and rather widely spaced delicate ribs, which gradually become much closer on the last embryonic whorl. There are $2\frac{1}{2}$ whorls in the embryonic shell, which is somewhat cylindric, and .8 mm. in diameter at the last whorl. The sculpture then abruptly changes to the adult type. The earlier post-embryonic whorls are convex; the later ones are flattened peripherally, being obtusely biangular. Sculpture of slightly irregular, widely spaced ribs, which are more prominent where they pass over the angles at shoulder and base of each whorl. There are 14 ribs on the last, 15 on penult whorl. The intervals are closely sculptured with very low rounded spiral cords and a few unequal, in part subobsolete vertical striae.

Haiti: Cape Haitian (J. B. Henderson).

This species seems to be closely related to *V. acuticostata* of Western Cuba. It has a narrower and shorter embryonic shell, of a half-whorl less, and there are more ribs on the later whorls. I have not been able to compare it with the East Cuban *V. tuberculata*, which from the imperfect description seems to be different, though closely related. A

perfect specimen of *V. inopinata* would probably be about 9 mm. long.

Jamaican Species.

Jamaica has a large number of forms still very imperfectly known. Of two of them, *V. gossei* and *V. osculans*, I have seen no examples. Special study must be given to the embryonic whorls, which show varying degrees of acceleration of the sculpture, the heterogeneous sculpture of the later stages being sometimes carried upward upon the embryo.

I. Intervals between the narrow ribs smooth and glossy.

V. lioderma, no. 17.

II. Intervals between the ribs vertically striated.

a. Large forms, 13 to 20 mm. long, 3 to 4 wide, with 9 to 10½ whorls; pale brown with reddish streaks or clouding.

b. 19 to 21 narrow, irregular ribs on last whorl, intervals with about 9 striæ.

V. adamsiana, no. 9.

b¹. 30 to 33 ribs on last whorl, 5 to 8 striæ in each interval; last embryonic whorl with 4 or 5 striæ in intervals between riblets.

V. chittyana, no. 11.

b². About 20 ribs on last whorl, intervals with minute waved striæ; embryonic whorls finely costulate.

V. davidensis, no. 10.

a¹. Smaller forms, 7 to 14 mm. long, less than 3 wide.

b. Last whorl with 12 to 14 delicate lamellar ribs, higher on the shoulder, intervals with 25 to 40 very fine striæ.

c. 12 x 2.6 mm., 9 or 10 whorls, remotely ribbed, striate between the ribs, details unknown.

V. gossei, no. 12.

c¹. Axis but slightly sinuous, no false umbilicus visible from the base.

V. gracilior, no. 14.

c². Axis spiral, a false umbilicus visible in basal view.

d. 8.75 x 1.5 mm., 9 flattened whorls.

V. osculans, no. 15.

*d*¹. 9.9 x 2 mm., 8½ moderately convex whorls. *V. mandevillensis*, no. 16.

*b*¹. Last whorl with stout ribs, intervals with about 22 fine striae 11.7 x 2.9 mm., whorls 9.

V. c. multistriata, no. 13e.

*b*². Usually with 20 to 30 delicate riblets on last whorl, intervals with 8 to 13 striae.

V. costulata, no. 13.

9. *V. ADAMSIANA* (Chitty). Pl. 12, figs. 4, 5.

“Shell conic, very slender; ground color very light brown, with rich dark umber transverse bands, light on the right and becoming dark gradually on the left side. There are three of these bands, with the intervening light brown on the last whorl. Upon the last 7 whorls these are very strong rounded waving ribs, 20 on the last whorl, and decreasing in number upwards; these are decussated by numerous spiral ridges. Beneath the ribs are very numerous microscopic striae. The ribs of each whorl project over the preceding one, causing the shell to be coronated. Above these 7 whorls, up to the apex the whorls are closely striated, with much arcuated striae. Spiral outlines slightly convex. Whorls 10½, well convex, with a well impressed suture. Aperture short, the upper part projecting angularly from the whorl above: well rounded below, till it meets the columella almost at right angles. Labrum sharp, constricted inwards about one-third down. Columella rather straight, slender and pointed. Divergence about 15°, length .8, breadth .14 [20 x 3.5 mm.]. (*Chitty*).

Jamaica: Swift River, St. George's (*Chitty*); Port Antonio (*Henderson*); Richmond Vale (*Mrs. E. M. Swainson*).

Achatina adamsiana CHITTY, Contrib. to Conch. p. 14 (Oct. 1853).—PFR., Monogr. iv, 610.

This is the largest species of its group. There are 3 embryonic whorls, the first smooth, the next two closely rib-striate, the riblets a little oblique, narrower than their inter-

vals. On the last embryonic whorl the intervals show several striae parallel to the riblets. The post-nepionic whorls are sculptured with rather rude, *waved or irregular, widely-spaced riblets*, 19 to 21 on the last whorl, the intervals with about 9 coarse striae, also somewhat waved. There are also numerous very low rounded spiral cords. The varices are low and inconspicuous, whitish, more arcuate than the ribs, each preceded by a reddish-brown stripe. The color elsewhere is very pale brown.

Length 19.7, diam. 3.9, length apert. 5 mm.; whorls $10\frac{1}{2}$.

Length 16, diam. 3.3, length apert. 4.3 mm.; whorls $9\frac{3}{4}$.

The specimen before me from Port Antonio is faded and broken, and may have washed down from the mountains.

10. *V. DAVIDENSIS* Pilsbry, n. sp. Pl. 14, figs. 34, 35.

One of the species labelled *A. gossei* in the C. B. Adams collection is evidently not that form and seems to differ from all known species. The dead shell is clouded with pale reddish brown and light ground, sculptured with stout, nearly straight vertical ribs, the crests one-half mm. apart at the periphery of the last whorl. The intervals are very minutely sculptured with waved striae (fig. 35). Whorls $9\frac{1}{2}$, the first $3\frac{1}{2}$ embryonic, more finely costulate. Aperture irregularly piriform, the columella vertical, obliquely truncate at its base. Length 13, diam. 3 mm., aperture 4 mm. long.

Jamaica: St. David's (C. B. Adams), type in coll. Amherst College.

11. *V. CHITYANA* Pilsbry, n. sp. Pl. 12, figs. 1, 2, 3.

Shell thin, pale brown, with faint traces of brown varix-streaks, of the usual turrit shape, the outlines slightly contracted near the apex, elsewhere straight or slightly convex. Whorls 9 to $9\frac{1}{2}$, moderately convex. Embryonic shell of 3 to $3\frac{1}{2}$ whorls, the first one smooth, the rest sculptured with well-spaced straight riblets, each interval with 4 or 5 parallel striae (pl. 14, fig. 33). Post-nepionic whorls with similar sculpture, but the riblets are slightly waved or irregular, 30 to 33 on the last whorl; the intervals have about

5 striæ; and there are very weak spiral cords, almost obsolete. There are two or three slightly projecting varices on the last whorl, distinguishable from ribs by their more arcuate, sinuous shape. They are preceded by very faint brown streaks. The last whorl is flattened peripherally. Aperture slightly oblique; columella vertical, obliquely and narrowly truncate at the base.

Length 16, diam. 3.9, aperture 4.1 mm.; whorls $9\frac{1}{2}$.

Length 14, diam. 3.3, aperture 3.7 mm.; whorls $9\frac{1}{4}$.

Length 14.9, diam. 3.2, aperture 4 mm.; whorls $9\frac{1}{3}$.

Jamaica (T. Bland). St. Davids (C. B. Ad.).

This species is represented by several lots in the collection of the Academy, and also is in the Adams collection at Amherst. It is related to *V. adamsiana*, but differs by the much more numerous and less waved ribs, fewer and finer striæ in the intervals, and by the much more robust embryonic shell, with striæ between the riblets throughout. In *V. chittyana* the last embryonic whorl has a diameter of fully 1.3 mm., while in *adamsiana* it hardly exceeds 1 mm. The embryonic shell usually consists of $3\frac{1}{3}$ to $3\frac{1}{2}$ whorls, but there is one specimen before me with only $2\frac{3}{4}$ whorls.

In the C. B. Adams collection there is a specimen of this species, under the name *A. gossei*, from St. Davids. It differs slightly from my types in having 7 to 8 threads in each intercostal interval, length 15, diam. 3.7, apert. 4 mm., whorls $9\frac{1}{3}$. The apex of this shell is figured, pl. 14, fig. 33.

There is also a form with longer whorls, and reaching a larger size, usually with 6 to 8 striæ in each interval, but with the same number of primary riblets. A specimen measures, length 20, diam. 3.75, aperture 4.9 mm., whorls $10\frac{1}{2}$.

12. *V. GOSSEI* (Pfeiffer). Pl. 14, fig. 31.

Shell subulate, thin, diaphanous, waxen, remotely ribbed, very finely striate vertically between the ribs on the last whorl. Whorls 9 to 10, a little convex, the last slightly more than one-fourth the total length. Columella oblique, reaching to the base of the aperture, shortly truncate. Aperture narrow, oblong; peristome simple, the right margin dilated

downwards. Length 12, diam. 2.66, aperture 3.33 x 1.33 mm. (*Pfr.*).

Jamaica (Ph. Gosse in Cuming coll.).

Achatina gossei PFR., P. Z. S. 1845, p. 138; Monogr. ii, 267.—REEVE, Conch. Icon. v, pl. 20, f. 114.

Reeve's figure is copied. I have not identified this species. It is smaller than *V. chittiana* with the same number of whorls, and it seems to be more remotely ribbed than that species. Pfeiffer's description is not sufficiently explicit concerning the details of sculpture.

13. *V. COSTULATA* (C. B. Adams). Pl. 13, figs. 10, 11, 12.

Shell small, conic, thin, diaphanous, brownish, with two black-brown bands; suture deep. Whorls 8, subangular above, furnished with very slender close riblets. Lip thin, retracted below. Columella not very much arched. Divergence 20 degrees. Length of spire .23; total length .335, width .1 inch. [8.37 x 2.5 mm.]. (*C. B. Ad.*).

Jamaica:

Achatina costulata C. B. Ad., Proc. Bost. Soc. Nat. Hist. ii, 1845, p. 13.—REEVE, Conch. Icon. v, pl. 20, f. 112 (March, 1850).—PFR., Monogr. ii, 267; iii, 497; iv, 610; vi, 231.—*Achatina adamsii* PFR., P. Z. S. 1845, p. 138.

Figs. 10-12 represent a specimen received from Adams. It measures, length 7.5, diam. 2.3 mm., whorls $7\frac{1}{2}$. The first $2\frac{1}{2}$ form a pupiform embryonic shell, which is about .9 mm. in diameter at the last whorl. The initial half whorl is smooth; then radial riblets set in, are rather coarse at first but become closer on the last embryonic whorl. They are nearly or about as wide as the intervals, are rounded and smooth; the intervals are also smooth. The post-nepionic whorls are all convex, the last somewhat less so but not flattened. Sculpture is of regular, narrow and delicate vertical riblets, reaching from suture to suture on the spire. On the last whorl they disappear at the base, and number about 28. The intervals have 8 or 9 parallel striæ, with no spiral cords or striæ. The varices are very low and inconspicuous. The shell is corneous with curved, longitudinal chestnut

streaks, 3 or 4 on a whorl, and more or less disposed to form longitudinal bands from whorl to whorl.

In some striped specimens of the same general appearance there are more interstitial striæ, 12 or 13 in each interval on the last whorl.

13a. Var. *fimbriatula* Pilsbry, n. v. Pl. 13, figs. 17, 21, 22.

Similar to var. *striatapex* in texture and color, but more slender; the riblets persist upon the last whorl, where there are 4 (or $3\frac{1}{2}$ intervals) in the space of one mm., with 8 to 10 wavy striæ in each interval (fig. 21). The apical whorls are weakly ribbed and striate (pl. 13, fig. 22). Length 7.9, diam. 2, aperture 2.2 mm. long, whorls $8\frac{1}{2}$.

Jamaica (coll. C. B. Adams).

13b. Var. *pallidula* Pils., n. v. Pl. 13, fig. 13.

The shell is very pale brown, without stripes. Sculpture of fewer more widely spaced riblets, irregular and in part subobsolete on the last whorl. Striæ about as fine as in *costulata*, but more numerous in each interval on account of the wider intercostal spaces. There is a faint appearance of spiral striæ, expressed in a slight crinkling of the striæ. Riblets and intervals of the embryonic shell smooth. Length 8.4, diam. 2.4 mm., whorls $8\frac{3}{4}$.

Jamaica (coll. A. N. S. P.).

13c. Var. *STRIATAPEX* Pilsbry, n. v. Pl. 13, figs. 15, 16, 19.

The shell has the last 3 whorls pinkish-corneous, the upper ones buff. $2\frac{3}{4}$ embryonic whorls are finely ribbed and *densely striate over the ribs and intervals* (pl. 13, figs. 15, 16). The next $2\frac{1}{2}$ or 3 whorls have spaced riblets; then they gradually become low and inconspicuous, decreasing to be merely larger striæ, on the last whorl about every 11th being larger, though it is difficult to make this out. The striæ are slightly waved, giving an appearance of faint spirals. Apical riblets are stronger than in var. *fimbriatula*. Length 9, diam. 2.6, aperture 3 mm.

Jamaica (C. B. Adams coll.).

13d. Var. *longa* Pilsbry, n. v. Pl. 13, fig. 20.

Shell long and slender, pale brown with dark red-brown streaks. Three embryonic whorls long, the first half-whorl smooth, the rest closely sculptured with arcuate, slightly flat riblets wider than their intervals. Subsequent whorls with strong riblets, arcuate above, about 24 on the last whorl, where their intervals have 9 or 10 striæ, and show very low, weak spiral cords. Aperture long and narrow. Varices inconspicuous, pale, preceded by a dark streak, two or three on a whorl. The last two whorls are somewhat flattened, the earlier ones convex. Suture deeply impressed. Length 10.3, diam. 2.6 mm., aperture 3 mm.; whorls $8\frac{1}{2}$.

Jamaica (S. L. Schumo). Type 75717 A. N. S. P.

Colored like *V. costulata*, but with much heavier riblets and longer whorls.

13e. Var. *MULTISTRIATA* Pilsbry, n. v. Pl. 13, figs. 14, 18.

The shell is pale yellowish-brown with a few dark dull-red streaks. The surface has a golden gleam in a strong light. There are three embryonic whorls, the first half-whorl smooth, the rest very finely rib-striate, the intervals smooth between the riblets (fig. 18); then six ribbed whorls follow. The ribs are arched above, rather stout, but very much narrower than their intervals. On the front of the last whorl there are about $2\frac{3}{4}$ intervals in 1 mm., or in other words, the distance from crest to crest of the ribs is about .36 mm. There are about 22 wavy striæ in each interval. Length 11.7, diam. 2.9, aperture 3.6 mm.

Jamaica (C. B. Adams coll.).

Very much like var. *longa*, but there are twice as many striæ in the intervals between the ribs on the last whorl. Fig. 14 is merely in outline.

14. V. *GRACILIOR* (C. B. Adams). Pl. 12, fig. 8.

“Shell conoidal, but very slender: pale horn color: with about twelve transverse oblique slightly prominent lamelloid ridges, which are more distinct next below the suture: apex rather acute: spire with the outlines nearly rectilinear:

whorls eleven, a little convex, with a distinct suture: aperture ovate, very acute above, retreating below on both sides, but less on the left side: labrum thin: columella moderately arcuated and truncated. Mean divergence about 9° ; length of spire .43 inch; total length .55 inch; breadth .09 inch." [13.75 x 2.25 mm.]. (Adams).

Jamaica: (Adams); Ipswich and Williamsfield (J. B. Henderson).

Achatina gracilior C. B. A., Contrib. to Conch. no. 7, p. 104 (April, 1850).—PFR., Monogr. iii, p. 503; iv, 616; vi, 237.

This species is related to *V. costulata* but differs by its more slender shape, widely spaced ribs and the excessively minute interstitial striation.

No specimen agreeing fully with Adams' description has been found in his collection. The single shell under the name *gracilior* (pl. 12, fig. 8) is broken and in bad condition, measuring 11.1 x 2 mm., with $9\frac{1}{4}$ whorls. It originally had about one-fourth of a whorl more. The first half whorl is smooth, next $2\frac{1}{2}$ are closely obliquely striate; then follows the very widely spaced rib-sculpture of the adult stage. The ribs have been worn from the later whorls, only faint vestiges remaining.

Specimens from Williamsfield, a place about 15 miles north of Savanna-la-Mar, (pl. 12, fig. 9), and from Ipswich, in the Henderson collection, seem to be referable to *gracilior*. One from the former locality measures 8.8 x 2.1 mm., with 8 whorls. The ribs are nearly obsolete on the last whorl. On the penult whorl there are 25 striæ in the intervals. An Ipswich shell has the ribs better developed, 12 or 13 on the last whorl, with 36 interstitial striæ. In these shells the columella is moderately arcuate, and weakly truncate at base. No false-umbilicus is visible in a basal view. In an oblique view, as in pl. 12 fig. 8, where the last whorl has been partly broken away, the columellar margin appears nearly straight.

The internal axis is slender and only moderately sinuous. It is drawn (pl. 14, fig. 27) from a shell 8 mm. long with $8\frac{1}{2}$ whorls, and having about 40 striæ in the intervals on the last whorl.

15. *V. OSCULANS* (C. B. Adams).

"Shell conoidal, but very slender; dull horn color; with about fourteen transverse oblique rather prominent lamelloid ridges, which are somewhat arcuated with the convexity forwards: apex rather obtuse: spire with the outlines rectilinear, except near the apex: whorls nine, flattened or concave along the middle, with a well impressed suture: aperture ovate, very narrow and acute above, retreating much below on both sides: columella subspiral, distinctly truncated in a young shell, indistinctly so in an old one, with the edge somewhat dilated, so as to resemble a *Spiraxis*. Mean divergence about 9° ; length of spire .28 inch; total length .35 inch; breadth .06 inch." [8.75 x 1.5 mm.]. (*Adams*).

Jamaica (C. B. Adams).

Achatina osculans C. B. A., Contrib. to Conch. no. 7, p. 104 (April, 1850).

I did not find this species in the Adams collection at Amherst. Cf. *V. mandevillensis*.

16. *V. MANDEVILLENSIS* n. sp. Pl. 12, figs. 6, 7; pl. 14, fig. 28.

The shell is very slender, pale brown or almost corneous, thin, composed of about $8\frac{1}{2}$ moderately convex whorls parted by a deeply cut suture. The first $2\frac{3}{4}$ whorls are embryonic, first $\frac{3}{4}$ whorl smooth, the next 2 obliquely striate, the striae smooth and about the width of the intervals. The rest of the whorls have widely spaced, slender and acute ribs, 12 or 13 on the last whorl, weakening below and obsolete at the base. There are also two low sigmoid varices. The intervals have a silky appearance, being sculptured with 35 to 40 minute, thread-like striae. The aperture is quite oblique, piriform, the basal margin retracted. Parietal margin slightly convex; columella somewhat concave, and weakly, obliquely truncate at the base. *Axis* (pl. 14, fig. 28) *spirally ascending*, a central hole or "false umbilicus" being more or less obvious in a basal view. Length 9.9, diam. 2 mm., whorls $8\frac{1}{2}$.

Jamaica: Mandeville (J. B. Henderson).

This beautiful species is closely related to *V. gracilior* in sculpture and shape, but differs by its spirally ascending

columellar axis. The columella is more concave than in *V. gracilior*. It is probably allied to *V. osculans*, but is somewhat larger with fewer whorls.

Fig. 7 represents the type. Another shell (pl. 12, fig. 6), exact locality unknown, has the ribs quite high, especially just below the suture, nine standing on the last whorl, intervals with 35 slightly crimped striae. The columella is quite strongly concave and the false-umbilicus comparatively large.

17. *V. LIODERMA* Pilsbry, n. sp. Pl. 14, fig. 37.

The shell is conic-turrite, thin, pale subtransparent brown, with a few curved reddish longitudinal streaks, about two on each whorl. $3\frac{1}{2}$ whorls form the densely rib-striate embryonic shell. $4\frac{1}{2}$ post-embryonic whorls are very convex below the suture, very glossy, sculptured with widely spaced white ribs, which are high and strong on the rounded shoulder, but weaken rapidly downwards, barely reaching the suture below, and obsolete on the base of the last whorl. There are 9 ribs on the last whorl. The polished intervals are faintly striatulate, but without distinct striae. There are one or two very weakly raised varices on each of the later whorls. The aperture is narrowly ovate, narrow above and below; columella vertical, curving into the parietal margin, strongly truncated obliquely at the base. Length 9, diam. 2.8, length of aperture 3 mm.

Jamaica. Type 2941 A. N. S. P.; Montpellier (J. B. Henderson).

This species is readily recognized by the entire absence of thread-like striae in the intercostal spaces, which are polished and show only faint wrinkles under a compound microscope. None of the specimens examined is mature. Probably a full grown shell would measure 2 or 3 mm. more in length.

Species of Trinidad and Panama.

The following species seem to belong to the *V. gracillima* group. *V. coronata* was based on a single shell, which later was supposed by Guppy to be introduced. *Bulimus fimbriatus* Forbes was collected during the voyage of the Herald and Pandora. The shells brought back were, it is notorious, often

wrongly localized. Forbes himself seems to doubt the assigned habitat of *B. fimbriatus*, writing of it as "less certain as to exact locality, though contained in a box labelled 'Panama.'"

18. V. CORONATA (Guppy).

"Shell obsoletely rimate, subulate, fusiformly cylindrical, white, adorned by low, distant, somewhat sinuate, longitudinal riblets, of which there are about eighteen on a whorl; whorls 8-9, scarcely convex, the upper ones step-like, slowly increasing, the lower ones nearly equal; the last somewhat narrowed; aperture narrow; peristome simple, its margins joined by a narrow callus on the body-whorl. Length 7, width 2, aperture 1.25 x .5 mm." (*Guppy*).

Trinidad, a single specimen, probably introduced (*Guppy*).

Stenogyra coronata GUPPY, Ann. and Mag. of Nat. Hist. 4 Ser., i, p. 439 (June, 1868); Proc. Sci. Asso. Trinidad 1869, p. 239; Journ. of Conch. vii, p. 231.—TATE, Ann. Mag. 4 Ser., iv, 1869, p. 356.—*Bulimus coronatus* Guppy, PFR. Monogr. viii, p. 141.

"Allied to *S. gracillima* Pfr., Cuba." "Of *Stenogyra coronata* I never saw but one example, and believe it must have been accidentally introduced" (*Guppy*). Tate has reported the species with doubt from St. Lucia.

19. V. FIMBRIATA (Forbes). Pl. 14, fig. 36.

Shell imperforate, subulate, thin, sculptured with subarcuate longitudinal ribs with close parallel lines in the interstices of the ribs; reddish-brown. Suture impressed. Whorls 7 to 8, tumid, the last slightly more than one-third the total length, obsoletely carinate below the middle. Columella nearly simple, forming an angle at the base of the aperture. Aperture suboval, peristome simple. Length 9, diam. 2, aperture 2 x 1 mm. (*Forbes*).

Panama (Herald & Pandora exped.).

Bulimus fimbriatus FORBES, Proc. Zool. Soc. Lond. 1850, p. 56, pl. 9, f. 7.—PFR., Monogr. iii, 394.—*Melaniella fimbriata* Forbes, MARTENS, Biologia Centr. Amer. Moll., p. 324.

The locality has not been confirmed. The shell seems to stand near Cuban species.

Section VARICELLULA Pilsbry, n. sect.

Slender, mostly small Varicellas with even sculpture of close rib-striae, and straightened columella with weak, oblique basal truncation. There are about $2\frac{1}{2}$ embryonic whorls, the first $\frac{1}{2}$ to $1\frac{1}{2}$ whorls smooth; outer lip simply arcuate. Type *V. blandiana*.

These forms resemble *Pichardiella* by their slender contour, weak columellar truncation and accelerated sculpture, which has extended over the greater part of the embryonic shell; but they differ by the even, homogeneous sculpture of the neanic and adult stages, more like *Varicella* s. str. All the species are Jamaican.

Key to species.

- I. Shell about 22 x 6 mm., sculptured with rather coarse rib-striae as wide as their intervals, nearly 5 in one mm. on the last whorl. *V. costulosa*, no. 25.
- II. Small, thin and delicate forms, less than 16 mm. long, with 7 to 10 striae in one mm. on the last whorl.
 - a. Shell corneous, without dark streaks, with sculpture of even low rounded riblets wider than their intervals; about $7\frac{1}{2}$ whorls, the first $1\frac{1}{2}$ smooth.
 - b. About 7.8 x 2 mm., 10 riblets in one mm. *V. tenera*, no. 24.
 - b¹. About 8.5 x 1.9 mm., 7 riblets in one mm. *V. t. roperi*, no. 24a.
 - a¹. Shell with dark varix-streaks or subsutural spots, 10 to 16 mm. long.
 - b. Riblets 7 in one mm., separated by spaces twice as wide as the riblets. *V. proxima*, no. 22.
 - b¹. Riblets as wide as the intervals or wider.
 - c. Suture puckered, the riblets arcuate below it, about 9 in one mm. *V. blandiana*, no. 21.
 - c¹. Suture simple, the riblets straight, about 7 in one mm.

d. Last whorls with dark streaks; shell about 12 x 3.25 mm.

V. propinqua, no. 20.

d¹. Later whorls with subsutural spots; shell 10 x 3 to 13.1 x 3.1 mm., with 6½ to 7½ whorls.

V. puella, no. 23.

20. *V. PROPINQUA* (C. B. Adams). Pl. 10, fig. 47.

"Related to the preceding species [*V. phillipsii*], perhaps a variety of it; but the shell is sculptured with close longitudinal lines, without an infrasutural line; whorls 6; columella straight. Divergence 18 degrees. Length of the spire .32 inch.; total length of the shell .48, width .13 inch" (*Ad.*). [Length 12, diam. 3.25 mm.].

Jamaica.

Achatina propinqua C. B. A., Proc. Boston Soc. N. H. ii, p. 13 (1845).

The type specimen (pl. 10, fig. 47) is in rather poor condition, having holes broken in the last two whorls, and the outer lip is imperfect. It is 12 mm. long, a trifle over three wide. It has straight vertical striae, not oblique or sigmoid, about 7 in a mm. on the front of the last whorl. The suture is hardly crenulated.

21. *V. BLANDIANA* (C. B. Adams). Pl. 10, figs. 48, 49.

"Shell regularly conic, but very slender: very pale brown or horn, with very dark brown transverse broad bent stripes, about three on each whorl, less distinct on the upper whorls, and wanting on the nuclear whorls: with rather fine regular transverse striae; rather thickly and very finely crenulated at the upper margin of the whorls: apex moderately obtuse, smooth on the first whorl: spire very long, with the outlines rectilinear: whorls nine, moderately convex, slightly and acutely shouldered above, with a well impressed suture: aperture rather long-ovate, small: labrum sharp, very thin: columella nearly straight. This species is most nearly allied to *A. propinqua*. Mean divergence about 16°; length .62 inch;

breadth .135 inch; length of aperture .16 inch." (Adams).

Jamaica: West of Port Antonio, Williamsfield and between Mandeville and Spurtree Hill (Henderson).

Achatina blandiana C. B. A., Contrib. to Conch. no 5, p. 83 (1850).

The type shell in Adams' collection is 15.5 mm. long with 9 whorls, the last one broken. I figure a specimen agreeing with it (figs. 48, 49). The riblets are as wide as their intervals and at the suture they partially unite in groups of two or three, forming *little prominences along the suture* (fig. 49), which though more or less conspicuous in different individuals, are very characteristic of the species. The riblets are distinctly arcuate below the suture, elsewhere oblique and straight, about 9 in a mm. on the last whorl. There are two or three varix-lines on each of the later whorls, each preceded by a conspicuous chestnut streak which recedes as it nears the suture above. These streaks are more conspicuous in the type than in most other lots of *blandiana* I have seen. The first half whorl is smooth, fine striæ beginning on the second. The upper part of the spire is rather attenuate. The locality of this typical form is unknown.

Many other specimens in the collections of the Academy and Henderson differ by the much less broad and conspicuous brown streaks and somewhat smaller size, one from Spurtree Hill measuring, length 13.5, diam. 3.5, length of aperture 4.1 mm., with $8\frac{1}{2}$ whorls. They are rather pale brown, with a whitish border on each side of the chestnut streaks.

22. V. PROXIMA (C. B. Adams). Pl. 10, figs. 50, 51, 52.

"Shell conic but slender: very pale brown or horn color; with dark brown transverse stripes, about three on each whorl, less distinct on the upper whorls: with fine regular transverse small elevated lamellæ: apex moderately obtuse, smooth on the nuclear whorls: spire long, with the outline nearly rectilinear: whorls eight, planulate, abruptly shouldered above, with a rather deep suture: aperture small, ovate: labrum thin and sharp: columella nearly straight. This shell

resembles *A. blandiana*. Its divergence in the upper whorls is less than in that shell, but its mean divergence is greater. Mean divergence about 18° ; length .385 inch; breadth .095 inch; length of aperture .11 inch." (*Adams*).

Jamaica: near Swift River head, Portland (C. B. A.). Swift River (Fox); West of Port Antonio (Henderson).

Achatina proxima C. B. A., Contrib. to Conch. no. 9, p. 167 (April, 1851).

The figures represent the best specimen of Adams' type lot, measuring, length 12, diam. 3, aperture 3.6 mm., whorls 8. There are four red-brown streaks on the last whorl, the next to the last one accompanying a distinct varix, the base of which shows in the figure. The first half whorl is smooth; following whorl with narrow radial grooves not reaching the suture below, and parted by flat intervals; the next whorl is vertically striate, and the rest ribbed; the riblets are parted by intervals of twice their own width. On the last whorl there are 7 riblets in one mm. The aperture is subvertical, the outer lip a little expanded, blunt, equably arched forward in the middle; basal lip somewhat retracted and broadly rounded. Parietal callus moderately developed. This species is readily separable from the related *V. blandiana* by the wider intercostal spaces and more attenuate spire, the diameter at the second or third whorl being decidedly greater in *blandiana*.

23. *V. PUELLA* (C. B. Adams). Pl. 10, figs. 53, 54.

"Shell ovate fusiform, much elongated: subtransparent, pale brownish yellow, with brown transverse stripes, which are very narrow except at their summits, where they are much dilated and are very deeply colored; there are on each whorl four or five of these stripes except near the apex: varicose coincidently with the brown stripes; with rather fine regular transverse striae: apex rather obtuse, with rather more than one whorl smooth: spire rather long, with the outlines a little curvilinear: whorls eight, moderately convex, with a well impressed suture: aperture rather long ovate, narrow and very acute above: labrum sharp and thin: columella

nearly straight, but little truncated. Mean divergence about 19° ; length .53 inch; breadth .125 inch; length of aperture .17 inch." (Adams.)

Jamaica.

Achatina puella C. B. Ad., Contrib. to Conch. no. 5, p. 83 (1850).—PFR., Monogr. iii, 504; Conchyl. Cab. p. 366, pl. 43, f. 17-20 (very bad).

Two cotypes are figured, since Adams' description was drawn from several individuals. His measurements apply to the largest example in the type lot (fig. 54), while the coloration was described from the better colored smaller shells. The specimens figured measure

Length 13.1, diam. 3.1, aperture 4 mm., whorls $7\frac{1}{2}$.

Length 10, diam. 3 mm., whorls $6\frac{1}{2}$.

The first whorl is smooth. The striation is coarser than in *V. blandiana*, and the striae are straighter. The streaks are paler, often so pale that only the chestnut subsutural spots are noticeable. The columella is nearly straight in an oblique view in the aperture, and very obliquely excised basally.

The relations of this species to *V. propinqua* need further investigation. They are very closely allied, and I doubt whether a specific distinction should be maintained.

24. *V. TENERA* (C. B. Adams). Pl. 10, fig. 56.

"Shell elongate, somewhat conic: horn color: with numerous well impressed regular transverse striae: apex subacute: spire with the outlines a little convex: whorls seven and one-half, scarcely convex, somewhat shouldered above, with a well impressed suture; aperture ovate, acute above: labrum thin, slightly advanced in the upper half, retreating below: columella moderately curved, distinctly truncated. Mean divergence about 14° ; length of spire .21 inch; total length .3 inch; breadth .075 inch." (Adams.)

Jamaica.

Achatina tenera C. B. A., Contrib. to Conch. no. 7, p. 104 (April, 1850).—PFR., Monogr. iii, 497.—? Nameless in REEVE, Conch. Icon. v, *Bulimus* pl. 84, fig. 121 (1849).

This species was based on a single specimen drawn in fig. 56. It measures 7.8 mm. long, 2 wide, aperture 2.4 mm. long, with fully $7\frac{1}{2}$ whorls. The first $1\frac{1}{2}$ whorls are smooth, the second whorl being somewhat disproportionately high. The sculpture is very even, of straight, low, rounded, riblets or plaits, wider than their interstices, about 10 in a mm. on the last whorl. There are three very inconspicuous varix-lines or growth-arrest lines, on the last whorl. The aperture is slightly oblique, the outer lip arched forward in the middle. Columella subvertical, somewhat concave above, curving into the parietal margin, obliquely truncate at the base.

24a. Var. *ROPERI* n. subsp. Pl. 10, fig. 55.

Specimens from Porus, Richmond Vale, and several lots without exact locality, differ from Adams' type by the more slender contour; narrower aperture, shorter columella and coarser sculpture, there being but 7 folds in one mm. on the last whorl. The first whorl only is smooth. One from Porus figured measures, length 8.5, diam. 1.9, length of aperture 2.1 mm.; whorls $7\frac{1}{2}$.

In basal view a minute axial perforation or false-umbilicus may be seen, as in *V. levis*.

Porus (Edw. W. Roper); Richmond Vale (Mrs. E. M. Swainson).

V. tenera is not closely related to the preceding forms. It stands between them and the group of *V. cochlidium*.

25. *V. COSTULOSA* (C. B. Adams). Pl. 7, figs. 14, 15, 16, 17.

"Shell conic, turritid: translucent, very pale brownish horn color, darker at the varices: with the surface apparently striated, but having on each whorl about seventy small approximate regular ribs; but the nuclear whorls are smooth; with rather indistinct varices, of which there are two or three on each whorl: apex rather obtuse; spire with the outlines nearly rectilinear, except near the apex: whorls nearly nine, moderately convex, with a well impressed suture: aperture broadly ovate: labrum not advanced along the middle, much

reflected in the lower half: columella moderately produced, nearly straight, well truncated. Mean divergence about 20° ; length of spire .65 inch; total length .86 inch; breadth .27 inch." (Adams.)

Jamaica: Pedro, St. Ann's (J. S. Hyde, in Adams coll.).

Achatina costulosa C. B. A., Contrib. to Conch. no. 6, p. 102 (March, 1850).

Typical specimens, agreeing exactly with Adams' types, are figured on plate 7. The first $1\frac{1}{2}$ whorls are smooth. Then rib-striae of the adult type abruptly appear. Sometimes the first two or three riblets after the smooth apex, do not extend to the suture below. The riblets are as wide as the intervals, nearly five in a mm. on the last whorl. The later whorls have about three inconspicuous varices, which are not preceded by brown streaks, at least in the "dead" specimens in collections I have seen. The outer lip is nearly in a plane, but weakly arched forward. The columella is very short, curving into the parietal wall above, obliquely truncate at base. Length 22, diam. 6, aperture 6.4 mm., whorls $8\frac{1}{2}$.

V. costulosa seems to be rare. I have never seen a fresh adult shell. There is a fresh young one in the Adams collection, of a clear corneous tint, translucent at the smooth base and apex.

This species is not closely related to the preceding, yet it seems nearer to them than to the typical section of *Varicella*.

Section VARICELLARIA Pilsbry, n. sect.

First $\frac{1}{2}$ to $1\frac{1}{2}$ whorls smooth; neanic and mature stages regularly ribbed or rib-striate, the intervals as wide as the striae; columella distinctly truncate at base. Type *V. procera*.

All of the species are from Jamaica.

The forms which are ribbed almost to the apex seem quite distinct from typical *Varicella* as the acute Strebel has already noticed; yet all stages in the acceleration of rib-sculpture are to be found in the several species, so that the taxonomic value of the character in this case is not great.

Key to species.

I. First $\frac{1}{2}$ to $\frac{3}{4}$ of a whorl smooth, the rest ribbed.

- a. Outer lip angular, base deeply receding, columella strongly twisted.
 - b. Solid, turrite, ribs coarse, 2 in one mm.; length about 30 mm. *V. procera*, no. 26.
 - b¹. Ribs finer, 4½ to 7 in one mm.; length 20 to 25 mm. *V. griffithii*, no. 27.
 - a¹. Outer lip convex, not angular; columella vertical, straightened, a concave zone at periphery; length 15 to 20 mm. *V. ligata*, no. 28.
- II. First whorl smooth, then fine riblets gradually begin; aperture nearly half the total length; outer lip arched forward.
 - a. Marked with bold wedge-shaped stripes; 3 riblets in one mm. *V. philippiana*, no. 29.
 - a¹. Stripes narrower; 5 to 7 riblets in one mm. *V. p. elegans*, no. 30.
- III. First whorl smooth, the second and third with rather widely spaced grooves; aperture not much more than one-third the total length; lip arched forward near the base; columella short and straight; 3 spots in place of a varix-streak. *V. jamaicensis*, no. 30.

26. *V. PROCERA* (C. B. Adams). Pl. 7, figs. 1-5.

Adams' type lot consists of 18 specimens, wholly similar to those drawn in my figs. 3, 4. The species is readily known by its large size and turrite shape, the very prominent angle of the outer lip, deeply excised basal lip, and sinuous columella. The first half-whorl is smooth; then begin regular riblets. The limit of the nepionic period is not marked by any change of sculpture, but possibly is indicated by the first colored streak, which is at the end of 3½ whorls. Very weak traces of coarse spiral striæ are usually visible on the last whorl.

Jamaica.

Achatina procera C. B. A., Contrib. to Conch. no. 2, p. 24 (Oct. 1849).

27. *V. GRIFFITHII* (C. B. Adams). Pl. 7, figs. 6, 7.

"Shell thin, diaphanous, pale brownish, ornamented with

a few distant black-brown longitudinal lines; whorls $7\frac{1}{2}$, with an impressed infrasutural line, costulate, the costulae very close, not much raised, and rounded. Aperture elongate, acute above, somewhat channelled below; lip thin, angular in the middle, strongly retracted below; columella strongly twisted. Divergence 28° , length of spire .46, total length of shell .81, diam. .275 inch." (*Ad.*).

Jamaica.

Achatina griffithsii C. B. A., Proc. Bost. Soc. N. H. ii, p. 14 (1845).—REEVE, Conch. Icon. v. *Achatina*, pl. 15, f. 64.—*A. griffithii*, C. B. Ad., Contrib. to Conch. no. 8, p. 129 (1851).

Three examples of the typical form are preserved in the Amherst collection, besides a set of 5 and another of 15 specimens representing varieties.

The first half whorl is smooth; the following whorl is coarsely costulate, and the next whorl more finely so. The nepionic stage terminates at $2\frac{1}{2}$ whorls, but the neanic sculpture is similar to the preceding whorl. On the last whorl the riblets are fine, rounded and close, equal to the intervals, seven in a mm. (fig. 7). There are generally three varices on the last whorl, the last two projecting a little. They are preceded by narrow brown streaks which are interrupted at the periphery and very narrow below it. The last half of the last whorl is constricted in the middle, the rib-striae waving forward there. The lip projects angularly and is thickened in the middle, excised and receding below the angle. The columella is very strongly twisted, as in *V. procera*.

Var. *chittyi*, n. v. Pl. 7 figs. 8, 9.

Somewhat larger than *V. griffithii*, with coarser striation, about $4\frac{1}{2}$ to 5 striae in a mm. on the last whorl; riblets of second whorl coarser. Lip generally not so strongly angular, and the columella is less contorted. Whitish corneous, with somewhat bolder stripes than typical *griffithii*. Length 23.7, diam. 8, aperture 10.5 mm., whorls $8\frac{1}{2}$.

Jamaica, type no. 2915 coll. A. N. S. Specimens were taken by Mr. Henderson at Mulgrave and Montpelier. A

series of 15 is in the Adams collection at Amherst, and several other lots without exact locality are before me.

Var. *ischna* n. v. Pl. 7, figs. 10, 11, 12, 13.

More slender and lengthened than *V. griffithii*, with somewhat coarser striation, 5 or 6 striæ in a mm. on the last whorl, and more whorls. Length 21.2, diam. 6, aperture 9 mm., whorls $9\frac{1}{2}$.

Jamaica, type no. 2914 A. N. S. Specimens from Mt. Diablo, in coll. Henderson, are less slender, length 22, diam. 7, aperture 9.8 mm. (fig. 13). Similar shells were taken by him at Bog Walk. This variety is also represented in the Adams collection. A specimen was figured for *V. ligata* in Vol. I, pl. 3, f. 7.

28. *V. LIGATA* (C. B. Adams). Pl. 11, figs. 57, 58.

"Shell elongate, subconic, with a broad deep constriction around the middle of the last whorl; pale brown, with dark brown narrow transverse stripes, which are sometimes nearly obsolete, of which there are about three on each whorl, except on the first three or four, which have none; varicate at the last one or two brown stripes, with rather fine crowded transverse striæ; spire with the outlines moderately convex; apex small; whorls about seven and one half, a little convex with a well impressed suture; aperture long, much modified by the intrusion of the labrum at the constriction of the last whorl; labrum thickened at the constriction; columella a little twisted and arcuated. Mean divergence 24° ; length .68 inch; breadth .195 inch; length of aperture .26 inch." (*Adams*).

Jamaica.

Achatina ligata C. B. A., Contrib. to Conch. no. 2, p. 25 (Oct. 1849).

The Adams collection contains a lot of ten specimens, of which three are young. There are two varieties represented, a more slender (typical) and a larger, stouter form. A specimen agreeing so closely with the original measurements that it must be the type, is figured, pl. 11, fig. 58; length 17,

diam. 5; aperture 6.1 mm., whorls $8\frac{1}{3}$. The constriction of the last whorl is confined to its later half. Each of the last three whorls has three narrow brown streaks. The first half whorl at the apex is smooth. The outer lip is prominent below the middle, but is not angular there, and projects forward less than in *V. griffithii ischna*. This is the chief distinction between the two forms. The columella in *ligata* is vertical, nearly straight, curving into the parietal wall above, and obliquely truncated basally. Tryon's figure intended for *V. ligata* was drawn from a specimen of *V. griffithii ischna*.

There is a small, pale corneous form, with very inconspicuous brown streaks, and a deep and conspicuous concave zone around the whole last whorl. Specimens from Mandeville (Henderson coll.) are figured, pl. 8, figs. 33, 34, 35. One measures, length 15, diam. 4.7, aperture 6 mm., whorls $7\frac{1}{2}$.

Another form in the Adams collection is larger, more robust than typical *V. ligata*, with slightly coarser striation. Length 20.7, diam. 6.5, aperture 8 mm., whorls $8\frac{1}{2}$ (pl. 8, fig. 36; pl. 11, fig. 57). This form differs from *V. griffithii* and its varieties by the depressed, concave zone of the last half of the last whorl, and the curved but not angular outer lip.

Group of V. philippiana.

29. *V. PHILIPPIANA* (Pfeiffer). Pl. 8, figs. 21-27.

The shell is whitish-corneous, boldly painted with reddish-brown stripes, widest above, and interrupted in the middle on the last whorl. There are generally 3 to 5 of these broad stripes on the last whorl. The first whorl is smooth; rib-striae then appear, becoming gradually stronger and coarser. At the end of $3\frac{1}{2}$ whorls there is a streak and varix, probably indicating the extent of the embryonic shell (fig. 24). The rib-striae are very regular and beautiful on the later whorls, the riblets and intervals being equal. On the last there are about 3 riblets in a mm. The whorls, especially the last, are swollen just below the suture. The last whorl

is flattened and tapers slightly downwards below the sutural inflation. The suture is very narrowly channelled. The outer lip is very slightly arched forward below the middle, basal lip somewhat receding. The columella is very strongly twisted. Large examples measure, length 31, diam. 11.5, aperture 14.7 mm.; whorls $9\frac{1}{3}$.

There is some variation in sculpture. A specimen from Mulgrave (figs. 26, 27) has coarser riblets than most others examined.

Jamaica: Grand Vale, a sugar estate near Kilmarnock (Gosse); Maroontown and Westmoreland (E. Chitty in coll. C. B. Adams); Mulgrave (J. B. Henderson).

Achatina philippiana PFR., Symbolæ ad Hist. Hel. iii, p. 90, no. 402, 1846; Monogr. ii, p. 291.—REEVE, Conch. Icon. v, pl. 14, f. 49.—GOSSE, A Naturalist's Sojourn in Jamaica, p. 124.

The habitat of Pfeiffer's type from the Cuming coll. was unknown, but Ph. Gosse, returning from Jamaica about the time of its description, brought specimens from Grand Vale.

29a. Var. *elegans* (C. B. Adams). Pl. 8, figs. 28, 29, 30.

Smaller than *V. philippiana*, less swollen below the suture, with the chestnut stripes narrower. The striation is decidedly finer than in *philippiana*, there being five striæ in a mm. on the last whorl.

Length 23.5, diam. 9, aperture 11 mm.

Length 28.5, diam. 9.7, aperture 12.5 mm.

Figures 28, 29 are from a specimen received from Adams, and agreeing fully with his type lot at Amherst. A larger, more boldly marked shell, typical in sculpture, is drawn in fig. 30. This variety occurs in Manchester.

Achatina elegans C. B. A., Contrib. to Conch. 2, p. 25 (1849).

Finely striate form. At Mandeville and Bog Walk Mr. Henderson collected some remarkably handsome specimens, of a tawny color, with dark but narrow chestnut stripes, and more numerous striæ, nearly seven in a mm. on the last whorl (pl. 8, figs. 31, 32 Mandeville).

Group of V. jamaicensis.

The narrow, widely separated grooves of the second and third whorls are a peculiar feature of this group.

30. *V. JAMAICENSIS* (Pfeiffer). Pl. 7, figs. 18, 19, 20.

The first whorl is smooth; the second and third vertically grooved, the grooves narrow, separated by low, wide and rather flat riblets. At the end of the third whorl these give place abruptly to the strong angular ribs of the neanic and adult stages (fig. 18). These ribs are equal to their intervals, and straight except on the last whorl, where they curve forward below the periphery. There are about 3 ribs in 1 mm., on the last whorl. On each of the later whorls there are about three varices. Those on the spire are marked by two, on the last whorl by three brown spots. Columella short and straight, obliquely truncate.

Length 23, diam. 7.4, aperture 8 mm.; whorls $9\frac{1}{2}$.

Length 19, diam. 6.4, aperture 6.5 mm.; whorls $8\frac{3}{4}$.

Jamaica: Bluefields (Gosse).

Achatina jamaicensis PFR., P. Z. S. 1845, p. 137; Monogr. ii, p. 290.

Section VARICELLOPSIS Pilsbry, n. sect.

Varicellas of moderate or large size, with sculpture of vertical riblets and spiral grooves; varices and outer lip nearly straight, not angular or otherwise specialized in the sub-peripheral region. Embryonic shell of $3\frac{1}{3}$ whorls, with the initial $\frac{3}{4}$ whorl smooth, the rest finely costulate; post-embryonic sculpture coarser. Type *V. peruviana*.

This group is probably confined to Haiti, but the locality of *V. peruviana* is still unknown. The type, *V. peruviana*, resembles Jamaican forms of the section *Varicellaria*.

Two species are grouped here, *V. peruviana* with coarse costulae and deeply cut suture, and *V. richardi*, a form with much finer sculpture.

31. *V. PERUVIANA* (Lamarck). Vol. I, pl. 11, fig. 97.

The first $\frac{1}{2}$ to $\frac{3}{4}$ whorl is smooth; the next $2\frac{1}{2}$ whorls are finely striate vertically, the whole embryonic shell apparently consisting of nearly $3\frac{1}{2}$ whorls. Then the ribbed.

neanic stage begins with occasional red-brown streaks. There are a few very inconspicuous varices on the later whorls (3 on the last). The surface is marked with impressed spiral lines. The suture is channelled more conspicuously than in *V. procera*, and the internal axis is very sinuous.

Achatina peruviana LAM., Anim. s. Vert. vi, pl. 2, p. 132 (April 1822).—DELESSERT, Rec. de Coq. pl. 28, f. 5.—PFR., Monogr. ii, p. 294.—REEVE, C. Icon. v, pl. 14, f. 57.—*Helix pretiosa* Fér., Prodr. no. 362 bis, Histoire, pl. 135, f. 4.—*Streptostyla peruviana* Pfr., Nomencl. Hel. Viv. p. 13.—TRYON, Man. Conch. i, p. 43.

Although credited to Peru, this species may turn out to be from Haiti or possibly Jamaica. It was one of the Dombey shells described by Lamarek, and still remains an extremely rare species. It is known to me by an imperfect example in coll. A. N. S. P.

32. *V. RICHARDI* (Pfeiffer). Vol. I, p. 43, pl. 11, figs. 85, 86.

A rather thin shell with sculpture of close longitudinal folds, obsolete below the middle, and having close spiral lines throughout. It has angular irregular streaks of chestnut, and brown spots. The outer lip is somewhat arcuate. Length 28, diam. 11 mm., whorls 7.

Barahona, Santo Domingo (Sallé). Cf. Crosse. Journ. de Conchyl. 1891, p. 102, who places the species in *Streptostyla*. I have not seen specimens.

Section VARICELLIDEA Pilsbry, n. sect.

Large forms with rough, coarsely reticulate sculpture of vertical folds and spiral grooves, the varices and outer lip almost straight in profile view; spire long; columella abruptly truncate at the base. Characters of the embryonic whorls unknown. Type *V. texta*.

The shells of this Haitian group have sculpture somewhat like a loosely woven fabric, reminding one of the Urocoptid group *Archegocoptis*. It is related, by its spiral sculpture and straight lip and varices to *Varicellopsis*. Two species are known, both very rare, *V. fulminea* being still unique, almost a century since its description.

33. V. TEXTA (Weinland et Martens). Pl. 19, figs. 47, 48, 49.

Shell fusiform-turrite, reticulate sculptured with spiral sulci and impressed points, plicate at the suture; black-brown, painted with paler flames. Spire long, the apex obtuse; suture filiform. Whorls 9, nearly flat, the upper 5 uni-colored, the last wanting impressed points on the base. Aperture ovate-elliptical, acute above, slightly more than one-third the total length. Columella obliquely twisted, distinctly truncate, white; peristome simple, the outer margin slightly arcuate, not impressed, columellar margin with a very slight appressed callus. Length 37, diam. 12, aperture 14 x 6 mm. (*Martens*).

Haiti: Jeremie (Weinland, Henderson and Simpson).

Glandina texta W. & M., MARTS., Malak. Bl. vi, p. 207 (1860).

This very peculiar form has not hitherto been figured. It is known to me by two fragments in the Henderson collection, the larger of which is figured. The columella is sinuous, having a cork-screw twist. There are five varices on the last whorl, counting one at its beginning. The outer lip is very slightly arched forward in profile view, nearly straight. The sculpture consists of close and fine but quite irregular vertical folds, decussated by much coarser spirals, in some places showing also fine superficial spiral lines, and over all are scattered irregular shallow pits or impressions. The latter are wanting on the base, where the spirals are much closer than above. The detail figure (fig. 49) shows a small area below the suture.

34. V. FULMINEA (Lamarck). Vol. I, pl. 7, fig. 90.

Shell turrite, very finely decussate, with alternating oblong-squarish spots and angularly bent streaks of reddish-violet separated by whitish ground. Suture crispate; spire with obtuse and reddish apex. Length 2 inches 5 lines (*Lam.*).

Habitat unknown, probably Haiti.

Helix fulminea FÉR., Prodr., p. 51, no. 366 (name only).

—*Achatina fulminea* LAM., Anim. s. Vert. vi, pt. 2, p. 133, no.

17 (April, 1822).—DELESSERT Recueil de Coq. décrites par Lamarek, pl. 28, f. 6a,b.—PFR., Monogr. ii, p. 293.

This fine species is still known only by the original description and Delessert's figures. These indicate a shell closely related to *V. texta*, but differing by its larger size and less curved columella. There are occasional straight white varices, probably four on the last whorl, each preceded by a zigzag blackish stripe inclosed in a pale streak; the remainder of the intervariceal spaces being reddish. Delessert's figures measure, length 63, diam. 20, length of aperture 25 mm.

Férussac gave the locality *l'Amerique*, with doubt. From the resemblance of the species to *V. texta*, I think it will be found in southwestern Haiti.

Section VARICELLINA Pilsbry, n. sect.

Varicellas with abruptly truncate columella, the surface sculptured with strongly sinuous rounded riblets wider than the intervening grooves; varices indistinctly marked with an impressed line and a whitish streak. First $1\frac{1}{2}$ whorls smooth, the next whorl marked with rather widely spaced grooves. Type *V. curvilabris*.

There are two species: *V. curvilabris*, stouter and larger, length 14 to 17 mm., with $7\frac{1}{2}$ to 8 whorls, and *V. vicina*, more slender, 12 to 14 mm. long, with $6\frac{1}{2}$ to 7 whorls. Both are Jamaican.

35. *V. CURVILABRIS* (Pfeiffer). Pl. 9, figs. 37, 38, 39, 40.

The largest examples have a somewhat cylindric last whorl and conic spire. It is widest near the top of the last whorl. The sculpture is of very regular, low rounded and markedly sinuous riblets, separated by narrow grooves. On the face of the last whorl there are five riblets in one mm. There are some inconspicuous varix-lines, the largest shell before me having 4 on the last whorl. The apex is rather acute and elevated, first $1\frac{1}{2}$ whorls smooth. The next whorl has narrow grooves with wide flat intervals; the following whorl is short, compared to those above and below it, and sculp-

tured like the later whorls, but more closely and finely. The upper half of the aperture is very narrow. The outer lip is straightened in the middle, or a trifle bent in. In profile it arches forward in a broad curve, and is somewhat thickened from the middle down. The columella is short, and very strongly truncate at the base. Length 17, diam. 5.9, aperture 8.2 mm., whorls 8.

Jamaica.

Glandina curvilabris PFR., P. Z. S. 1845, p. 137.—*Achatina c.*, PFR., Monogr. ii, p. 258.—REEVE, Conch. Icon. v, pl. 18, f. 94.—*Oleacina c.*, TRYON, Man. Conch. i, p. 30, pl. 3, f. 23.

Pfeiffer's type, the figure of which is copied in Vol. I, was a more lengthened, less robust form with shorter and less narrow aperture, length 16, diam. 5, aperture 6.75 mm., with 8 whorls.

There is also a variety, lengthened like typical form, in which there is a drop-like callous thickening at the middle of the outer lip. The sculpture is coarser, there being about $3\frac{1}{2}$ riblets in a mm. on the last whorl. Length 14.4, diam. 4.9, aperture 7 mm., whorls $7\frac{1}{2}$.

36. V. VICINA (C. B. Adams). Pl. 9, figs. 41 to 46.

"Perhaps a variety of *A. phillipsii*, but the shell is sculptured with close longitudinal striae, is never banded with brown; the infra-sutural line is further from the suture, and the spire is shorter. Divergence 22° , length of spire .3, total length .54 inch., width .175 inch." (*Ad.*).

Jamaica: Pedro, St. Anns (Hyde); Montpelier (Henderson).

Achatina vicina C. B. A., Proc. Boston Soc. N. H. ii, p. 14 (1845).—PFR., Monogr. ii, p. 265.—*Oleacina vicina* Ad., PFR., Nomencl. Hel. Viv. p. 7.—TRYON, Man. Conch. i, p. 31, pl. 3, f. 32.

The type lot consists of nine specimens, one of them figured, pl. 9, fig. 44. There are a few very inconspicuous varices marked by a light hair-line and a pale streak on the pale yellowish-corneous shell. The columella is straight and vertical in profile view; outer lip equably arched forward.

There are 5 ribs to a mm. on the face of the last whorl. The figured shell measures, length 12, diam. 3.7, length of aperture 5 mm.; whorls $6\frac{1}{2}$. No locality is given.

Another specimen is in the Adams collection from Pedro, St. Anns, J. S. Hyde. It has only three plaits in a mm. on the last whorl and measures, length 11.5, diam. 3.8, aperture 5 mm.; whorls $6\frac{1}{2}$, the first $1\frac{1}{2}$ smooth. See pl. 9, fig. 43.

Most of the series before me agree with typical *vicina* or are intermediate between that and the coarsely sculptured form. Figs. 45, 46 is a typical specimen, length 11.7, diam. 3.4, aperture 5 mm., whorls $6\frac{1}{2}$. There are nearly 5 ribs in a mm. Figs. 41, 42 are a larger shell, 14×4.1 mm., aperture 6.1 mm., whorls 7, with $3\frac{1}{2}$ ribs in a mm.

Section VARICELLA s. str.

Embryonic shell obtusely conic or pupiform, of $2\frac{1}{2}$ to 3 whorls, all smooth, or rarely with fine striae on the last half whorl; the subsequent whorls striate between the varices, the striae wider than the intervening grooves, or with widely spaced grooves; never spirally striate. Columella straight or concave. Type *V. leucozonias*.

Distribution, Jamaica, middle and eastern Cuba, Haiti and Porto Rico.

This group is more widely distributed than any other except *Pichardiella*. In having the embryonic whorls smooth it is less specialized than most other phyla of the genus, but in a few Jamaican species, the last embryonic whorl or half whorl has been invaded by fine striation of the neanic type. Forms widely different in size, shape and sculpture are included in the group, yet there are transitional species which seem to make its division on conchological grounds impracticable. What the soft anatomy will show is still unknown.

A. Jamaican Species.

- I. Outer lip strongly sinuous, projecting forward in a rounded lobe at the lower third; richly colored forms.

- a. Large, 35 to over 40 mm. long; columella strongly concave.

b. Blackish chestnut or chocolate, with white streaks. *V. leucozonias*, no. 37.

b¹. Roseate with short chestnut stripes.

V. dominicensis, no. 38.

a¹. Smaller, 17 to 18.5 mm., with straight columella; pale brown, with a white stripe before each varix, shading into dark brown upon the next varix.

V. deflorescens, no. 39.

II. Outer lip arcuate, with a small point or callous drop at the lower third; surface evenly, closely striate; usually with varix-stripes.

a. Pink to cream-colored, with an inconspicuous point on the lip; columella straightened; $4\frac{1}{2}$ to 7 striæ in a mm.

V. angiostroma, no. 41.

a¹. Roseate, with a callous point on the lip; columella concave; 3 to 4 striæ in one mm.; 22 to 25 x 9 mm.

V. venusta, no. 40

a². A small callous pad within the edge of the lip; 5 to 6 riblets in a mm.; last half-whorl of the embryonic shell closely striate; diam. about one-third the length; 15 x 5 to 18.3 x 5.9 mm.

V. phillippsi, no. 42.

a³. Outer lip with a minute point or callous drop at the lower third; last whorl of the embryonic shell with widely spaced grooves; length 18 to 27 mm.

V. nemorensis, no. 43.

III. Outer lip simply arcuate; no false umbilicus visible from the base.

a. Roseate orange-brown with chestnut streaks; finely striate; 23 to 25 x 7 mm. with 7 whorls.

V. taylori, no. 44.

a¹. Roseate with chestnut streaks; last whorl with spaced grooves below the suture, subobsolete on middle and base; 24 x 8 mm.

V. nitida, no. 45.

a². Pale brown or yellowish corneous with brown streaks; slender, the diameter less than one-third of the length.

- b. Subarcuately closely costulate; 13 x 3.5 mm. with 9 whorls. *V. arcuata*, no. 46.
- b¹. With excessively minute crowded striae; 13 x 3.75 mm., 8 whorls. *V. solitaria*, no. 47.
- b². With irregularly spaced grooves; 24 x 6 mm. or smaller. *V. similis*, no. 48.
- IV. Outer lip arcuate; a false umbilicus visible from the base; slender pale corneous forms, with faint brown streaks or none.
- a. Shell 17 to 18 mm. long, 4 to 4.7 wide, with 8½ to 9 whorls, sculpture of few very weak, unequally spaced grooves. *V. similis*, no. 49.
- a¹. 11.25 by 2.25 mm., 10 whorls; very lightly impressed striae, not very numerous. *V. longispira*, no. 50.
- a². 11 x 2.8 mm., whorls 7½; very few weak impressed lines on the smooth surface. *V. levis*, no. 51.
- a³. Smaller, less than 8 mm. long, less than 2 mm. wide.
- b. Post-embryonic whorls all closely and regularly grooved.
- c. About 30 grooves on the last whorl; 6.8 x 1.5 mm., with 7 whorls. *V. clappi*, no. 53.
- c¹. About 25 grooves on last whorl, obsolete on periphery and base; false-umbilicus very wide; 5.3 x 1 to 5.9 x 1.2 mm., with 7½ whorls. *V. cochlidium*, no. 54.
- b¹. Third and fourth whorls with rather close, regular grooves, the last 2 whorls with widely spaced grooves, usually about 9 to 12 on each.
- c. Columella abruptly truncate at base; 6.5 x 1.66 mm. with 6⅔ whorls to 7.3 x 1.8 mm. with 7½ whorls. *V. pellucens*, no. 52.
- c¹. Columella deeply concave above, very obliquely (vertically) truncate at base; 6.3 x 1.35 mm., with 6¾ whorls. *V. spina*, no. 55.

B. *Cuban Species.*

- I. Outer lip with a small projection or point at the lower third; length 18 to 26 mm., the diam. more than one-third the length.
- a. Earlier post-embryonic whorls with close, fine striæ.
 - b. Later whorls with few, widely spaced grooves.
V. trinitaria, no. 58.
 - b¹. Later whorls with close, fine grooves.
V. multilineata, no. 59.
 - a¹. Post-embryonic whorls with widely spaced grooves.
V. swiftiana, no. 60.
- II. Outer lip simply arcuate; diam. one-third of the length or less.
- a. Diam. about one-fourth the length; corneous or amber-tinted forms.
 - b. 8 x 2 mm., with 6 whorls; sculpture of narrow grooves separated by wider smooth intervals; a narrow false-umbilicus.
V. elata, no. 56.
 - b¹. 9.5 x 2.3 mm. with 9 whorls; closely striate.
V. subulatoides, no. 57.
 - b². 15 x 4 mm., whorls 7½, smoothish with a few impressed lines.
V. succinea, no. 62.
 - a¹. Diam. one-third the length; smoothish with indistinct varices; 15 x 5 mm. with 7 whorls.
V. gundlachi, no. 61.

C. *Species of Haiti, Porto Rico and the Virgin Islands.*

- I. Columella with a fold above and obliquely truncate at base; closely hair-striate; slender, 6.5 to 9 mm. long.
Haiti. *V. biplicata*, no. 65.
- II. Columella normal.
- a. Conspicuously streaked and flamed with brown; 23 x 8 mm. Haiti. *V. histrio*, no. 66.
 - a¹. Pale, usually with darker varix-streaks.
 - b. A small point at the lower third of the lip.
Haiti. *V. denticulata*, no. 63.
 - b¹. No point on the lip.

- c. With subsutural plication; 13 x 5 mm. with 6 whorls. Haiti.

V. ptychoraphe, no. 64.

- c¹. With unequally spaced grooves, not plicate above; about 20 x 6 mm., with 8 whorls. Porto Rico.

V. portoricensis, no. 69.

- c². Much smaller, slender, diam. 3 mm. or less.

d. Sculpture of weak, irregularly spaced grooves. *V. impressa*, no. 67.

- d¹. Sculpture of regular, deeply impressed grooves.

V. sulculosa, no. 68.

37. *V. LEUCOZONIAS* (Gmelin). Vol. I, pp. 26, 251.

The first two whorls are smooth; on the third some weak striae appear. At the end of the third whorl there is a linear varix, marking the end of the embryonic shell, beyond which regular impressed lines cut the surface into flat wide riblets, and occasional white varix-streaks appear. The last whorl, in the typical form, has a sculpture of flat, wide riblets parted by narrow grooves, near the suture, but this sculpture weakens and largely disappears on the middle part and base of the whorl, where it is smooth except for irregular fine growth-wrinkles.

Portland parish, Jamaica.

Das Thurmchen, WALCH, *Der Naturforscher*, Halle, iv, 1774, p. 36, 37, pl. 1, f. 3, 4.—*Strombus edentulus perelegans* etc. MARTINI, *Conchyl. Cab.* iv, 1780, p. 220, pl. 148, f. 1371, 1372.—*Voluta leucozonias* GMEL., *Syst. Nat.* 13, p. 3453 (1790), based on preceding references.—*Achatina albolineata* LAM., *Anim. s. Vert.* vi. pt. 2, p. 132 (1822).—*Achatina leucozonias* Walch, PFR., *Monogr.* ii, p. 280.

I have been unable to find that Walch proposed a Latin name for this snail in his verbose article in *Der Naturforscher*, although he figured it well. Martini's figures were from a drawing supplied by Walch. The first binomial term was applied by Gmelin, so far as I can learn.



Var. *striatella* nov. There is a form in which the sculpture grows stronger on the later whorls. On the last, the surface between the varices is closely and very regularly rib-striate, the striae rounded, parted by very narrow intervals, and continuing from suture to base. Whether these shells constitute a distinct race or subspecies I am unable to say, in the absence of a well localized series.

38. V. DOMINICENSIS (Gmelin). Vol. I, p. 26, 251.

Eastern Jamaica. Evidence that this species occurs in Haiti or Santo Domingo does not exist.

39. V. DEFLORESCENS (Vendryes). Pl. 17, fig. 17.

"Shell elongated, sub-fusiform, turreted, shining; color rather pale brown, generally with dark chestnut-brown, somewhat arcuated streaks, a set of which run coincidently with the varices completely across each whorl. The painting of the shell is singularly varied; each successive whorl presents at the start a semi-translucent, sharply-defined and pure white stripe, which gradually passes into pale brown, then slowly deepens in color as the whorl progresses, into a warmer tint and finally merges into an intensely dark-brown stripe, covering the varix forward, which varix marks the termination of a stage of growth. This gradually changing color scheme is always repeated between the several varices, but it is less noticeable upon the upper part of the spire, although actually traceable almost to the apex. Shell regularly sculptured with not very crowded rib-like striae. Whorls 8, very slightly convex and obsoletely angular just below the upper margin, which is crenulated by the passing over of the striae. Suture moderately impressed. Last whorl a little more than one-third the entire length. Outline of spire slightly curvilinear; apex pointed. Aperture ovate, oblong, considerably dilated at right side of base; labrum not sharp. Columella white, straight, well truncated with a strong callosity deeply impressed and folded by the entering striae and varices which pass to and over it from the shell.

Length 17 to 18.5, diam. 5, length of aperture 6, diam. 2 mm." (Vendryes).

Jamaica: Moore Town, Parish of Portland (Geo. Nutt).

Glandina (*Varicella*) *deflorescens* VEND., Nautilus xiv, p. 134, fig. 2 (April, 1901).

"The peculiarities of the columellar callus, impressed with the marks of the sculpture of the shell, and of the dilation of part of the labrum on the right side of the base of the aperture, allies this species with *Glandina leucozonias* and *dominicensis*, both of which occur in the Parish of Portland in the extreme eastern part of the island." (*Vendryes*).

40. V. VENUSTA (Pfeiffer). Vol. I, p. 28, pl. 3, fig. 16.

Pfeiffer's description was from young shells, one of which has been figured by Philippi (Abbild. I, *Glandina* pl. 1, f. 9). It reaches a length of 25 mm. The first $2\frac{3}{4}$ whorls are smooth, a fine pale line then marking the beginning of the sculptured portion. The rest of the shell is very evenly, closely striate, on the last whorl about 3 to 4 striæ in a mm. The outer lip arches forward slightly, and below the middle there is a small white oblong nodule on its inner edge and face. The brown stripes are narrow, and white-bordered on both sides.

Westmoreland (E. Chitty, in Adams and Swift coll.); Grand Vale estate, near Kilmarnock (Gosse, Nat. in Jamaica, p. 124).

41. V. ANGIOSTOMA (C. B. Adams). Pl. 16, fig. 7.

"Shell fusiform; pale reddish, with transverse rather narrow dark brown stripes, of which there are about four on each whorl except on the first three; with extremely fine crowded transverse striæ; spire with moderately convex outlines; apex rather small; whorls seven, moderately convex, with a well impressed suture; aperture very long and narrow; labrum very thin and sharp; columella produced to an extraordinary degree, straight, a little twisted. Mean divergence 34° ; length .72 inch; breadth .22 inch; length of aperture .36 inch." (*Adams*).

Achatina angiosoma C. B. A., Contrib. to Conch. no. 2, p. 25 (Oct., 1849).—*Achatina ingallsiana* C. B. A., l. c. no.

2, p. 25.—*Achatina unicolor* C. B. A., t. c. p. 26.—*Achatina gayana* C. B. A., t. c. no. 7, p. 103 (April, 1850).

After a careful study of Adams' types of the above species, I do not hesitate to rank them as varieties of a single species. They differ only in slight details of color and striation.

The two specimens of *V. angiostoma* in the Adams collection are both broken. The best one, which I have drawn (fig. 7), measures 17.7 x 6 mm. in its broken condition, with $6\frac{1}{2}$ whorls. Though not exactly agreeing with Adams' measurements, I think this is probably the type. It is pale rose colored, with three chestnut streaks on the last, four on the two preceding whorls. There are two smooth apical whorls. There are 6 or 7 flattened striæ in a mm. on the last whorl, separated by narrower linear grooves.

41a. Var. *ingallsiana* (C. B. Adams). Pl. 16, figs. 1, 2.

"Shell fusiform; pale brownish, with but four or five dark brown transverse stripes; with very minute rather numerous but not crowded transverse striæ; spire with moderately convex outlines; apex rather small; whorls seven, moderately convex, with a well impressed finely corded suture; aperture very long, rather narrow; lip thin, with the edge sharp and curved forwards; columella moderately produced and arcuate. Mean divergence 36° ; length .75 inch; breadth .25 inch; length of aperture .35 inch." (Adams).

The single example in coll. Adams is figured. It is a thin, delicate shell, rose-tinted, with inconspicuous pale ochre-chestnut varix-streaks, 5 on the last, 4 on the preceding, 3 on the next earlier whorl. It is finely plicatulate, very regularly so on the spire and upper part of the last whorl, where there are about 5 striæ in a mm.; but some of the striæ drop out, failing to reach the periphery, and the base is smooth around the columellar region. The first $2\frac{1}{3}$ whorls are smooth. The outer lip is retracted above, evenly arcuate except for a minute point projecting at the lower third. The columella is vertical, nearly straight, obliquely truncate at base.

The following form is probably a mere variation of *ingallsiana*, not a true race or subspecies.

41b. Var. *unicolor* (C. B. Adams). Pl. 16, fig. 5.

"Species similar to the preceding, [*ingallsiana*] but the shell is uniformly light brown, without any dark stripes; the striae are rather more strongly impressed; the columella is not arcuate; and the form is rather more slender. Mean divergence 33° ; length .7 inch; breadth .21 inch; length of aperture .33 inch." (Adams).

The Adams collection contains one nearly adult shell (the type), and a young one. The type measures, length 17, diam. 5.5, aperture 8.5 mm., with $6\frac{1}{2}$ whorls. There are three varix-lines on each of the last two whorls. It is pale rose, with colorless varix-streaks. There are about $4\frac{1}{2}$ striae in a mm. on the last whorl. It differs from *V. a. ingallsiana* only in being a trifle more elongate, and without the faint color-streaks of that form.

41c. Var. *gayana* (C. B. Adams). Pl. 16, figs. 8, 9.

"Shell well elongated ovate-fusiform: light brownish yellow, with a series of very distinct triangular spots of dark brown, descending from the suture, about five or six on each whorl: varicose coincidently with the brown spots, the varices being rather feebly indicated, as in *A. nitida*; with fine regular rather crowded transverse striae: apex subacute: spire with the outlines a little convex: whorls seven or eight, rather convex, with a well impressed suture: aperture long ovate, acute above: labrum sharp and thin: columella nearly straight, rather narrow and obliquely truncated. Mean divergence 30° , length .76 inch; greatest breadth .27 inch; least breadth .25 inch; length of aperture .36 inch. This rare and elegant species is dedicated to my assistant Mr. A. M. Gay, in testimony of his industry and rapid acquisitions in natural history." (Adams).

There are three examples in the Adams collection, two larger than the immature type, and evidently added later, but doubtless of exactly the same race. They measure:

Length 22, diam. 6.9, aperture 9.5 mm.; whorls $7\frac{1}{3}$.

Length 21, diam. 7, aperture 9.3 mm.; whorls $7\frac{1}{3}$.

The longer shell is very glossy, pale buff, the early whorls

white, faintly showing the axis through. The chestnut spots behind the varix-lines on the last two whorls continue down as narrow streaks, but are absent on the lower third of the last whorl.

The stouter shell is pale olive-buff, the first $2\frac{1}{2}$ whorls rose-tinted. There are 5 varix-lines on the last, 4 on the penultimate whorl, with a triangular chestnut spot at the suture back of each. $2\frac{1}{2}$ apical whorls are smooth, the striæ then beginning very weakly. The sculpture is of even, fine, flat striæ, somewhat wider than the intervening grooves, and 5 in a mm. on the last whorl. The outer lip is hardly expanded, slightly ached forward, with a small and inconspicuous point at its lower third; basal lip receding. Columella is vertical, slightly sinuous, obliquely truncate basally.

42. *V. PHILLIPSI* (C. B. Adams). Pl. 11, fig. 63.

"Shell thin, diaphanous, elongate, subfusiform, pale brownish, ornamented with a few distant longitudinal black-brown lines. Whorls 7, impressed above with an infrasutural line, striated, the striæ distant. Lip thin, retracted below; columella not much arched. Divergence 20° , length of spire .5, total length .73, breadth .13 inch." (*Ad.*)

Jamaica: Swift River head, St. George (C. B. A.); Grand Vale estate near Kilmarnock (Gosse).

Achatina phillipsii C. B. A., Proc. Bost. Soc. N. H. ii, p. 13 (1845).—GOSSE, A Naturalist's Sojourn in Jamaica, p. 124. —*Glandina p.* W. G. BINNEY, Ann. N. Y. Acad. Sci. iii, p. 81, pl. 17, f. D (an outer marginal tooth).

Specimens of the type lot measure, length 15, diam. 5 mm., 15.5×4.9 , 17.3×5.5 , and 18.3×5.9 , aperture 7.9 mm., whorls $6\frac{3}{4}$. The last one is, I think, the original type. The diameter of the shell was wrongly stated by Adams, either by typographical error or from misreading the scale.

The shell is slender, last whorl somewhat cylindric, with sculpture of rather wide rounded or flattened rib-striæ, parted by narrower grooves. There are 5 to 6 ribs in a mm. on the front of the last whorl. The sculpture is obsolete on the base. There are about four varices on a whorl, each

marked with a narrow chestnut stripe which is interrupted below the periphery, and very weak below the interruption. The outer lip is thin, regularly arcuate, and below the middle bears a small triangular callous pad within the edge. The columella is but slightly concave, and is weakly obliquely truncate basally. There are three embryonic whorls, the last terminating with a varix-line and brown stripe. The half whorl preceding this varix is closely costulate like the following whorls, the earlier whorls being smooth. This species is related to *V. similis*, but differs by the stouter contour and much closer sculpture of the last whorl. The characters of the early whorls separate it from *V. nemorensis*, which is otherwise very closely related.

43. *V. NEMORENSIS* (C. B. Adams). Pl. 11, fig. 62, 65.

"Shell subfusiform; pale brown or pale reddish brown, with dark brown transverse stripes, which are not very wide, reaching nearly to the anterior extremity, about four on each whorl except on the first three, which have none; with very dense rather small striae; spire with the outlines quite convex; whorls eight, moderately convex, with a well impressed suture; aperture long, narrow in the upper half, and very acute above; labrum sharp, produced along the middle, a little angulated below the middle; columella nearly straight, rather slender, and pointed. Mean divergence 30° ; length .83 inch; breadth .25 inch; length of aperture .35 inch.

"Var. *a*, with very few brown stripes." (*Adams*).

Jamaica: Yallahs Hill (Jarvis); Morant Bay and Mancheneal (W. J. Fox); Hope Bay and Hope River (Henderson & Simpson); Manchester (C. B. Adams).

Achatina nemorensis C. B. A., Contrib. to Conch. no. 2, p. 25 (Oct., 1849).—PFR., Monogr. iii, p. 515; Conchyl. Cab. p. 351, pl. 38, f. 19, 20.

This species is very closely related to *V. phillipsii*, differing in little but the somewhat less attenuate spire and the sculpture of spaced grooves on the third whorl. The shell is so translucent as to show the axis faintly through. The type lot consists of about 20 specimens. The first $1\frac{3}{4}$ or 2 whorls

are smooth, the following $1\frac{1}{4}$ whorls are sculptured with widely spaced grooves. The varix terminating the nepionic stage is at the end of $2\frac{1}{2}$ to 3 whorls. The adult sculpture is of flatly rounded rib-striae parted by narrower grooves and about 5 in a mm. on the last whorl. The columella is straight, obliquely truncate at base. The outer lip is very lightly arched forward, and there is a minute point or callous drop on the white edge, at its lower third.

Length 23, diam. 6.4, aperture 8.8 mm., whorls $7\frac{1}{2}$.

Length 18.2, diam. 5.9, aperture 8.5 mm., whorls $6\frac{1}{2}$.

Some specimens from Yallahs Hill are very pale buff with the brown streaks emphatic above, tapering and paler downwards. 24×7 , ap. 9.9 mm., whorls $7\frac{1}{2}$. Those from other places mentioned above are not so large, not exceeding 20 mm. long. Those from Manchester, in the Adams collection, are olive-buff tinted.

44. V. TAYLORI (Vendryes). Pl. 16, fig. 6.

"Shell much elongated, oblong-fusiform, not very shining, often semi-pellucid, of a brown color, deeply-tinted with rose orange; with narrow dark, reddish-hued or chestnut transverse streaks, crossing completely over all the whorls but not always extending to the base of the last whorl, but always coincident with and bordering the varices, of which there are four to five upon each whorl. Shell sculptured with fine transverse striae, which become more apparent on the upper shoulder of the body whorl, next to the suture. Whorls 7, slightly convex, but in most cases perceptibly flattened or constricted at the periphery; the last whorl more than one-half the entire length of the shell. Suture impressed, the edge somewhat crenulated at one margin by the intrusion of the transverse striae. Spire with the outlines somewhat curvilinear, rather pointed at the summit. Aperture not large, semi-ovate; labrum sharp, slightly produced towards the middle and below that point, gradually retreating, expanding and rounding off to meet the twisted, arcuated and obliquely truncate columella. Length 23 to 25, greatest diam. 7, or slightly less. Length of aperture 9, largest diam. 4 mm." (Vendryes).

Jamaica: Half Way Tree Pen, Parish of St. Catherine. (C. B. Taylor).

Glandina (Varicella) taylori VEND., Nautilus xiv, p. 133, fig. 1 (April, 1901).

"This shell resembles *G. nemorensis* in form but is considerably larger. In the outline of the spire it comes between *G. nemorensis* and *G. similis*, but it is larger than either of these species. The strigæ are slightly broader than in *nemorensis* and not nearly so broad as in *similis*. In color it differs from both." (*Vendryes*). Known to me by the original description and figure only.

45. V. NITIDA (C. B. Adams). Pl. 11, fig. 59.

"Shell well elongated, ovate-fusiform; reddish brown, with very dark brown transverse stripes, about four or five on each whorl; varicose coincidently with the brown stripes, the varices being indicated by the thickening of the shell within, and a deeply impressed line in front of each; well polished and shining. Apex subacute; spire with the outlines rectilinear, or moderately convex. Whorls 7 or 8, moderately convex, with a well impressed suture. Aperture long, very acute above; labrum sharp, subangular at two-thirds of the distance from its upper extremity; columella much curved, broadly truncated. Mean divergence 30° to 35° ; length .96 inch; greatest breadth .31 inch; least breadth .3 inch; length of aperture .44 inch." (*Adams*).

Jamaica: Westmoreland (Chitty).

Achatina nitida C. B. A., Contrib. to Conch. no. 7, p. 103 (April, 1850).

The type lot consists of six specimens labelled "Westmoreland, E. Chitty." The embryonic shell consists of $2\frac{3}{4}$ whorls, smooth except the last half whorl, which shows some faint fine growth-striæ. The following whorls have fine unequal grooves, some short, others more emphatic and extending from suture to suture. The last two whorls have vertical grooves at nearly regular intervals below the suture. They are mainly quite short, but on close inspection a few fine long ones may be seen. The columella is vertical, con-

cave in the middle, convex above and below. The outer lip is straight, a little prominent where it joins the retracted basal lip, but without a tooth or callus at the lower third. An average specimen measures, length 24, diam. 8, aperture 11.6 mm.

This species is quite distinct in sculpture from all related forms.

46. *V. ARCUATA* (Pfeiffer). Pl. 17, fig. 13.

Shell fusiform-turrite, rather thin, glossy, subarcuately and closely costulate; amber-yellowish, ornamented with narrow, remote arcuate reddish pale-bordered streaks. Spire subulate, acute, the suture crenulate. Whorls 9, flat, the last about one-third the total length. Columella somewhat straightened, shortly truncate. Aperture oblong, peristome simple. Length 13, diam. 3.5, aperture 4.33 mm. long, 2 wide. (*Pfr.*).

Jamaica (Gosse, Mus. Cuming).

Glandina arcuata PFR., Proc. Zool. Soc. 1845, p. 138.—*Achatina arcuata* PFR., Monogr. ii, p. 261.—Not *A. arcuata* Reeve, Conch. Icon. v, pl. 17, f. 83 (1849), nor *O. arcuata* of Tryon, Man. Conch. i, p. 31.

Pfeiffer's original description, translated above, was probably based upon a shell different from that described and figured by Reeve, followed by Tryon. The sculpture and the shape of the columella, as described by Pfeiffer, do not agree with Reeve's description and figure.

I have figured on pl. 17, fig. 13, a shell which agrees well with Pfeiffer's diagnosis except in having three-fourths of a whorl less in a slightly larger shell. It is narrowly turrite, the upper fourth tapering much more rapidly than the rest of the shell, the last three whorls having a somewhat cylindric contour. The first $2\frac{1}{2}$ whorls form the smooth, pupiform embryonic shell. Subsequent whorls are sculptured with irregularly spaced vertical grooves. The last whorl is not grooved; the sculpture is closer and more regular than on the spire, consisting of low, rather coarse vertical striæ. On the face of the last whorl there are 6 of

these striae in one mm. There are three quite arcuate varices, each preceded by a narrow brown stripe with whitish borders. The outer lip arches rather strongly forward in the middle. The columella is short and vertical in both front and profile view, obliquely truncate basally. Length 14, diam. 3.75, aperture 5 mm., whorls $8\frac{1}{3}$.

47. *V. SOLITARIA* (C. B. Adams).

"Shell elongate, ovate conic: pale brown; with dark brown transverse lines, about three on each whorl, wanting on the first two or three whorls: with excessively minute crowded transverse striae: spire with the outlines a little convex: apex rather small: whorls eight, moderately convex, slightly shouldered, with a rather deep suture; last whorl subplanulate, long: labrum thin, sharp, a little produced in the middle: columella well produced and turned a little to the left. Mean divergence about 20° : length .52 inch; breadth .15 inch; length of aperture .185 inch." (Adams).

Jamaica: New Hope, Westmoreland (Adams).

Achatina solitaria C. B. A., Contrib. to Conch. no. 9, p. 168 (April, 1851).—PFR., Monogr. iii, p. 497.

This small form, measuring about 13×3.7 mm., aperture 4.6 mm., is not present in the Adams collection. It was probably in that of Chitty. Adams places the species next to *V. ligata* in his catalogue.

48. *V. SIMILIS* (C. B. Adams). Pl. 17, figs. 10, 11.

"Shell similar to *A. nemorensis*, but the outlines of the spire are nearly rectilinear, and consequently the spire is more slender; the surface is highly polished, and has but a few excessively fine transverse striae; the brown stripes are wider. It also resembles *A. phillipsii*, but its spire is shorter, with a greater divergence. Mean divergence about 22° ; length of spire .45⁺ inch; total length .75 inch; breadth .23 inch." (Adams).

Jamaica: Bogwalk, Port Antonio, Ipswich, Pt. Gallina, between Mandeville and Spurtree Hill, Mt. Pleasant and Montego Bay (Henderson & Simpson); varieties at other localities, see below.

Achatina similis C. B. A., Contrib. to Conch. no. 7, p. 103 (April, 1850).

The type lot in Adams's collection contains thirteen specimens, one being drawn in fig. 10. $2\frac{1}{2}$ whorls at the apex are smooth, then fine vertical impressed lines begin, increasing gradually, and becoming almost regularly spaced, though on the later whorls there are often some minor ripples between the grooves, on the flat intervals. The shell is pale yellowish with rich chestnut varix-streaks, interior bluish-white. The distribution of colored streaks varies in different individuals, but there are generally two or three on each post-embryonic whorl. On the last whorl the streaks are continuous, or there may be narrow interruption at the lower third. The columella is very short and concave in front view, rather abruptly truncate. In profile view (fig. 11) it appears equally concave and generally without much callus. There is somewhat wide variation in the degree of concavity among different examples of the type lot and other lots before me. It is often more concave than in fig. 10. In a section, the slender axis is seen to bear a slender white spiral lamella, less sinuous than that of *V. similis*. The largest specimens measure 24×6 , apert. 8 mm., with $8\frac{1}{3}$ whorls. The type locality is unknown, but the typical form occurs at Bogwalk.

A smooth form, in which the grooves are weak and few, almost wanting on the later whorls, was taken by Henderson at Clarendon Park. The varices are marked as usual, but with very narrow brown stripes. The single example seen probably represents a subspecies.

West of Ocho Rios and at Mandeville, Henderson took a form with rather small aperture and unusually straight columella.

Var. *biplicatula* n. v. Pl. 17, fig. 12.

At Montpelier a handsome form was taken by Henderson, in which the columella, in oblique view, is seen to be *cal-loused*, with a *low superior fold*, wanting in typical *V. similis*. The shell is tawny with very dark chestnut stripes, interrupted at the lower third on the last whorl, and is very

glossy. The surface grooves weaken rapidly downwards. The figured specimen is 18.8 mm. long; the largest is 21 x 6, apert. 8 mm., with $7\frac{1}{2}$ whorls. The upper fold of the columellar callus is not always distinctly developed. The internal structure does not differ from *V. similis*.

Closely related to this form are shells taken by Henderson at Ipswich and Withorn, in which the groove-sculpture is decidedly stronger than in typical *similis*, and the columella approaches the form shown in var. *biplicatula*.

Var. *longa* n. v. Pl. 17, fig. 18.

At Mt. Diablo a very slender form was taken by Henderson. It is typical in sculpture and color, but has the *columella strongly concave*, calloused inside, yet the axis is not gyrate, no central hole being visible in basal view. The aperture is small, and the whorls are more numerous. Length 22.5, diam. 5, aperture 6 mm., whorls $9\frac{1}{2}$.

Group of V. cochlidium.

Small, slender, pellucid Varicellas with groove sculpture, inconspicuous varices, and about $2\frac{1}{3}$ smooth embryonic whorls; *columella strongly concave*, truncate basally; axis spirally ascending, in the typical forms coiled about a central hollow as seen from the base. This group in its typical species seems quite distinct, yet *V. similis* to some extent connects it with the typical group of *Varicella*, through *V. similis*.

49. *V. SIMILARIS* Pilsbry, n. sp. Pl. 17, figs. 14, 15, 16.

The shell is slender, turrite, thin, corneous-yellowish and somewhat translucent; general outlines of the spire nearly straight, but the whorls are convex. The apex is obtuse; embryonic shell of $2\frac{1}{2}$ whorls, the first two smooth, then fine and rather close striae very weakly beginning. The post-nepionic whorls have a very weak sculpture of unequally spaced grooves, much as in *V. similis* but weaker. The occasional varix-lines are rather weakly impressed, and either plain or preceded by a narrow brown streak, or by a faint spot below the suture. The aperture is small, piriform,

slightly oblique. Outer lip moderately arched forward, basal lip receding. The columella is extremely concave, short, and vertically truncate at the base. The internal axis is strongly sinuous (fig. 14); viewed from the base it is seen to gyrate around a small central hole. Length 17.5, diam. 4, aperture 4.9 mm., whorls $8\frac{3}{4}$.

Jamaica. Types no 59108 A. N. S. P., from R. Swift.

This form differs from *V. similis* by its very concave columella and gyrate axis. It is also less strongly sculptured than *similis*. It may be identical with *Achatina arcuata* Pfr. of Reeve, *Conchologia Iconica* v, pl. 17, f. 83, but that does not seem to be the *A. arcuata* of Pfeiffer. It is paler and smoother than *V. similis longa*, which moreover has not the strongly spiral columellar axis of this shell.

49a. Var. *mandevillensis* Pils., n. v. Pl. 17, fig. 19.

Pale olivaceous-yellow, with a few narrow chestnut varix-streaks. Later whorls without grooves, being weakly marked with growth-wrinkles only. Decidedly wider than *V. similis*. Length 17, diam. 4.7, aperture 5.5 mm., whorls $8\frac{1}{2}$. Mandeville. Type in coll. J. B. Henderson.

A smaller example in coll. A. N. S. measures 16.5 x 4.3, aperture 5 mm.

50. *V. LONGISPIRA* (C. B. Adams).

"Shell much elongated, conoidal; pale brown, shining, with very lightly impressed not very numerous transverse striae: apex obtuse: outlines of the spire slightly curvilinear: whorls ten, moderately convex, with a well impressed suture: aperture subrhomboidal, subacute above: labrum thin, slightly advanced in the upper half, retreating below: columella very oblique, distinctly truncated. Mean divergence about 12° ; length of spire .33 inch; total length, .45 inch; breadth .09 inch." (Adams).

Jamaica.

Achatina longispira C. B. A., Contrib. to Conch. no. 7, p. 104 (April, 1850); p. 183, no. 218.—PFR., Monogr. iii, 503.

I could not find the type of this species in the Adams collection. He place it between *tenera* and *proxima* in the catalogue of 1851. It is about 11.25 mm. long, 2.25 wide with 10 whorls.

51. V. LEVIS (C. B. Adams). Pl. 16, figs. 3, 4.

"Shell much elongated, conic; very pale brown, shining; very thin, smooth, with microscopic transverse striæ, which are quite numerous on the upper whorls; spire with rectilinear outlines; apex not very small; whorls seven, a little convex, with a moderately impressed suture; aperture ovate, acute above; labrum thin and sharp; columella slightly arcuate. Mean divergence 14° or 15° ; length .42 inch; breadth .1 inch; length of aperture .13 inch." (*Adams*).

Jamaica.

Achatina levis C. B. A., Contrib. to Conch. no. 2, p. 26 (Oct., 1849).—PFR., Monogr. iii, p. 502.—*Glandina levis* H. & A. Ad., Gen. Rec. Moll. ii, p. 109.

The type (pl. 16, figs. 3, 4) is a unique, dead, gray-white and opaque shell in the Adams collection. It measures, length 11, diam. 2.8, aperture 3 mm., whorls $7\frac{1}{2}$. The first $2\frac{1}{3}$ whorls are smooth; then some impressed lines appear, weaker than in allied species, and becoming sparser on the later whorls. Near the end of the penult. whorl there is a weak varix-line, preceded by a faint brown streak. The outer lip is unusually sinuous. The columella is short, concave above, slightly excised at the base, producing a very oblique truncation. In another example, in coll. A. N. S., the columellar truncation is less obvious, nearly obsolete. In other respects the two examples seen agree.

The very weak development of the groove sculpture distinguishes this species. In basal view a very minute false-umbilicus is seen, indicating a gyrate columellar axis. The weak, almost obsolete truncation of the columella is a feature unlike the associated species, and resembles forms of the *V. blandiana* group.

52. V. PELLUCENS (C. B. Adams). Pl. 18, figs. 20, 21.

Shell small, glossy, slender, corneous, ornamented with very

narrow longitudinal striæ, close above, distant below. Whorls 7. Lip thin, retracted below. Columella arcuate. Divergence 14 degrees, length .27, diam. .07 inch. (*C. B. Ad.*).

Jamaica (*C. B. Ad.*). Williamsfield (*J. B. Henderson*).

Achatina pellucens AD., Proc. Boston Soc. Nat. Hist. ii, 1845, p. 13; Contrib to Conch. no. 6, p. 90.—PFR., Monogr. ii, p. 295; iii, 502.

The single type specimen is figured. It is an acicular, glossy, translucent whitish-corneous shell. The first $2\frac{1}{3}$ whorls are smooth, forming a cylindric embryonic portion; then narrow grooves abruptly begin, and the next two whorls have them rather close and regular. The last $2\frac{1}{2}$ whorls have widely spaced grooves, 9 or 10 on each whorl; three on the last, two on the penult. being variceal or growth-arrest grooves, slightly deeper than the others, and preceded by a very faint brown streak. There are $6\frac{2}{3}$ whorls in all, the post-embryonic ones being gently convex, more convex just below the suture. The aperture is small, oblique; the outer lip arched forward above. The columella is deeply concave above and truncate basally. The basal margin is effuse or receding. Length 6.5, diam. 1.66 mm.

A specimen taken by Henderson at Williamsfield is larger, length 7.3, diam. 1.8 mm., with $7\frac{1}{3}$ whorls, and the grooves are not so widely spaced on the last two whorls, the disparity between the earlier and later whorls being less marked than in Adams's type. In basal view the false-umbilicus is barely visible, being much narrower than in *V. clappi*. The latter species is also narrower and tapers less rapidly.

53. *V. CLAPPI* Pilsbry, n. sp. Pl. 18, figs. 24, 25.

The shell is acicular, thin, glossy, whitish-corneous and somewhat transparent, composed of 7 whorls, the first $2\frac{1}{3}$ smooth, forming a somewhat cylindric summit. The following whorls are sculptured with slightly arcuate, regular and rather close longitudinal grooves, of which there are about 30 on the last whorl. At the periphery they disappear, leaving the base smooth. There are a few faint brown variceal streaks, about 2 on a whorl. The sutures are narrowly

but rather deeply impressed, the embryonic and last two whorls rather flattened, the intermediate ones somewhat more convex. The aperture is small, oblique, piriform. The outer lip arches forward above, and is retracted basally. The columella is deeply concave and basally truncate. The axis ascends spirally, so that in a basal view (fig. 25) a narrow false-umbilicus is seen. Length 6.8, diam. 1.5 mm.

Jamaica. Types 59070 A. N. S. P., from A. D. Brown coll.

This species is closely related to *V. pellucens* from which it differs by the even, close grooving of all the post-embryonic whorls, and by the somewhat more slender contour.

Some specimens in the Henderson collection are of a pale brownish-corneous tint. They came from the Holland collection, without exact locality.

A form from Mandeville (J. B. Henderson) has the periphery and base of the last whorl smooth, and the columellar axis more sinuous, producing a larger false umbilicus, though not so large as in the following form. It measures 6.9 x 1.5 mm., having $7\frac{1}{4}$ whorls.

54. *V. COCHLIDIUM* Pilsbry, n. sp. Pl. 18, figs. 26, 27.

The shell is acicular-cylindric, glossy, whitish-corneous (or pale brownish-corneous), composed of $7\frac{1}{3}$ whorls, the earlier ones somewhat convex, the last two nearly flat. Embryonic $2\frac{1}{3}$ whorls smooth; following whorls sculptured with slightly curved longitudinal grooves, parted by slightly wider convex intervals. There are about 25 grooves on the last whorl, where they become weak or obsolete on the base. There are one or two wider smoothish variceal streaks on each of the later whorls, but they are not conspicuous. The aperture is small, oblique, acutely piriform, dilated anteriorly. The outer lip is arched forward above the periphery, and recedes basally. The columella is calloused, forms a deep arch, and is truncate basally. Axis openly spiral, forming a broad and deep false umbilicus in a basal view. Length 5.3, diam. 1 mm.

Jamaica. Types 59071 A. N. S. P.

This species differs from *V. clappi* by its smaller size,

narrower contour and wider false umbilicus, the columella being more deeply arched and the axis therefore describing a more open spiral. Three specimens in the type lot are whitish, but one in coll. J. B. Henderson is pale translucent brown, and is also slightly larger, 5.9 x 1.2 mm., with $7\frac{1}{3}$ whorls.

55. *V. SPINA* Pilsbry, n. sp. Pl. 18, figs. 22, 23.

The shell is acicular, thin, yellowish corneous, glossy, composed of $6\frac{3}{4}$ whorls, which are convex just below the narrowly impressed suture, but elsewhere are nearly flat. First $2\frac{1}{3}$ whorls smooth, the summit obtuse, rounded. The following whorl is sculptured with rather close-set vertical grooves. The remaining whorls have irregularly and rather widely spaced grooves, and a few indistinct varix-grooves, two of the latter on the last whorl. The aperture is piriform, oblique; the outer lip arches forward above. The columella is deeply concave above, and tapers downwards, without a notch or truncation at the base. An extremely small false umbilicus is visible in a basal view. Length 6.3, diam. 1.35 mm., aperture 2 mm.

Jamaica: Ipswich, at the bottom of a deep "cockpit" (J. B. Henderson, Jr.).

This species resembles *V. pellucens* in sculpture, but differs in the form of the columella and the narrower contour.

Cuban Species.

V. elata seems to be related to the Jamaican species preceding; the other forms are more like those of Haiti, and the same type of shell extends to Porto Rico. According to Gundlach, the labial margins of *V. trinitaria* are not produced into long processes as is usual in *Oleacinidae*. I have not seen *subulatoides*, *succinea* or *gundlachi*, and the systematic positions of the former two are very uncertain.

56. *V. ELATA* ('Gundlach' Pfr.). Pl. 18, figs. 30, 31.

Shell fusiform-turrite, rather thin, sculptured with rather close hair-like striae, pellucid, glossy, waxy. Spire regularly

turrite, the apex obtuse. Whorls 6, rather flat, the last about two-fifths the total length, tapering basally. Columella arcuate, distinctly truncate above the base of the aperture. Aperture slightly oblique, angulate-oval; peristome simple, unexpanded, the right margin slightly dilated forward. Length 8, diam, scarcely over 2 mm., aperture 3 x 1.5 mm. (*Gundl.*).

Eastern Cuba: Jucaro near Cabo de Cruz (*Gundlach*).

Subulina elata GUNDL., Malak. Bl. iv, 1857, p. 173.—ARANGO, Fauna p. 98.—*Achatina e.*, PFR., Monogr. iv, 610; vi, 231.

"This species is closely related to *Achatina pellucens* and *costulata* Ad. of Jamaica, but differs from both in the comparatively much longer aperture and the strong truncation of the columella."

This species has not before been illustrated. It is figured here from a specimen received from Thomas Bland. It is pale yellowish corneous, subtranslucent and very glossy. The first $2\frac{1}{2}$ whorls are smooth and glossy. The rest are sculptured with narrow, slightly arcuate and nearly vertical grooves parted by wider smooth intervals. There are about 41 grooves on the last whorl of the shell figured. At first sight the sculpture appears quite regular, but on close examination occasional "varices" are seen, marked by a smoothish streak and deeper groove. There are four of these on the last whorl. The aperture is oblique, ovate, with the outer lip arching forward above as usual. The columella is very concave, and abruptly truncate at its base. In basal view a quite narrow false umbilicus is seen (fig. 30). Length 9, diam. 2.2, length of aperture 3 mm.; whorls $6\frac{1}{2}$.

V. elata is one of the very few Cuban *Oleacinidae* which show close affinities with Jamaican forms. It seems to belong to the *pellucens* group.

57. V. SUBULATOIDES (*Orbigny*). Vol. XVIII, pl. 44, fig. 56.

Shell long subcylindric, thin, white (in dead individuals), longitudinally striate; spire very long, the apex obtuse, subtruncate. Whorls 9. Aperture subrhomboidal; columella straight, truncate. Length 10, diam. 2 mm. (*Orb.*).

Cuba, in the interior (M. de la Sagra).

Achatina subulatoides ORB., Historia Cuba, v, Moluscos, p. 88, pl. 11 bis, f. 1-3 (1845); French edit. i, p. 168.—PFR., Monogr. ii, 267; iii, 502; iv, 617; vi, 238.—*Subulina* s., POEY, Memorias i, p. 396.—CROSSE, Journ. de Conch. 1890, p. 247.

A species of doubtful position, not recognized by later Cuban collectors. Pfeiffer states that there are two worn specimens in the Orbigny collection now in the British Museum, one immature, the other with imperfect mouth. He gives the following description: shell subulate, rather thin, closely striate, waxy (?); spire subcylindric, the apex obtuse; whorls 9, a little convex, the last about one-fourth the total length, smoother below the middle; columella somewhat twisted, slightly truncate. Aperture a little oblique, subangular at the base; peristome simple, thin. Length 9.5, diam. 2.33, apert. 2.25 mm. long.

58. V. TRINITARIA ('Gundl.' Poey). Pl. 11, fig. 64.

Shell subfusiform oblong, thin, pale tawny, obsoletely marked with darker incremental streaks; irregularly sculptured transversely with distant impressed striæ. Spire turrite, rather obtuse at the apex, the suture deep, contabulate. Whorls 8, a little convex, the last about one-third the length. Columella short, obliquely truncate. Aperture sub-semioval, peristome acute, a little produced forward. Length 26, diam. 10, aperture 10 mm. long, 4 wide. (Poey).

Central Cuba: Mountains of Trinidad at San Juan de Letran. (Gundlach).

Achatina trinitaria Gundl. MSS., POEY, Memorias ii, p. 36, pl. 8, f. 27 (1857). *Oleacina* t., Gundl. in PFR., Malak. Bl. iv, 1857, p. 109; Novit. Conch. iii, p. 320, pl. 77, f. 12-15.

Poey states that the lip of the animal is not bifid.

The specimen figured is smaller than the original type, and shows no dark varix-streaks. The first $2\frac{3}{4}$ whorls are smooth; then close, fine and subregular striæ abruptly begin, continuing about a whorl, when they become less regular, usually subobsolete near the lower suture, and on the later whorls persist only weakly below the suture, finally becom-

ing wholly obsolete. The last whorl is nearly smooth except for lightly impressed varix lines, of which there are four on the last, an equal number on the penult., and fewer very faint ones on the earlier whorls. The outer lip is slightly arched forward, and at its lower third a very small lobe or point projects, hardly shown in fig. 64. This point also shows on the varix-lines of the last whorl. The columella is concave above, prominent and abruptly truncate basally. Length 17.4, diam. 6.9, aperture 8 mm., whorls $6\frac{3}{4}$.

59. *V. MULTILINEATA* Pilsbry, n. sp. Pl. 11, fig. 60.

The shell resembles *V. trinitaria* in contour. It is thin, pale brown and glossy. The first $2\frac{1}{2}$ whorls are smooth; then close, fine striæ begin abruptly. This sculpture continues throughout the shell, the striæ slowly increasing. On the last whorl they are regularly arcuate, rounded, and much wider than the linear intervening grooves; at the lower third of the whorl they rather suddenly diminish, leaving the base almost smooth. On the front of the last whorl there about four striæ in the space of one mm. The varices are indistinct, and about five in number on the last whorl. The aperture is rhombic-ovate. Outer lip thin, well arched forward, with a very minute point projecting at its lower third. Columella nearly straight, abruptly truncate at the base. Length 18, diam. 6.9, aperture 8 mm. Whorls $6\frac{3}{4}$.

Cuba (A. D. Brown coll., from T. Bland).

This differs from the preceding form by the close, fine striation of the later whorls.

60. *V. SWIFTIANA* Pilsbry, n. sp. Pl. 11, fig. 61.

Shell turrite, the spire with straight outlines and obtuse apex; thin, corneous or corneous-brown. Surface glossy. First $2\frac{1}{2}$ whorls smooth; following whorls sculptured with *widely spaced, arcuate grooves* extending from suture to suture. The last whorl has unequal, irregularly spaced grooves, subobsolete on the base, and occasional varix-lines, four or five in number, each preceded by a narrow whitish streak. On preceding whorls the varices are very few and

inconspicuous. Aperture rhombic-ovate, outer lip slightly curved forward, with a very low point projecting at its lower third. Columella nearly straight, abruptly truncate basally. Length 20, diam. 7.9, aperture 8.8 mm., whorls 7.

Cuba.

This species differs from *V. trinitaria* by its strongly convex base and the widely spaced grooves of the post-nepionic whorls. The aperture is more rhombic in shape, and the point or denticle of the outer lip is a trifle smaller.

61. *V. GUNDLACHI* (Pfeiffer). Vol. I, p. 28.

Cuba: San Juan de Letran near Trinidad. More slender than *V. trinitaria*, with sharper apex, indistinct varices, crenulate suture and rounded instead of angular outer lip. 15 x 5 mm., aperture 5 mm. long.

62. *V. SUCCINEA* ('Gundlach' Pfr.).

Shell turrite, thin, smoothish, irregularly marked with varix-like impressed lines; pellucid, amber-colored. Spire regularly tapering, the apex rather obtuse, suture impressed. Whorls $7\frac{1}{2}$, rather flat, the last about one-third the total length, slightly tapering at the base; columella lightly arcuate, narrowly but distinctly truncate above the base of the shell. Aperture a little oblique, sinuate-oblong, angular above; peristome simple, unexpanded, the right margin slightly arched forward. Length 15, diam. scarcely 4, aperture 5 x 2 mm. (Pfr.).

Eastern Cuba: "Brazo del Cauto" near Santiago (Gundlach); also Buenavista, in Bayamo, and Monte Toro and Monte Libano in Guantanamo (*Gundl.*).

Subulina succinea Gundl. PFR., Malak. Bl. v, 1858, p. 185.—ARANGO, Fauna, p. 98.—*Achatina succinea* PFR., Monogr. vi, 237.—*Subulina megalogyra* Gundl., POEY, Memorias ii, p. 8, 438, name only.

This unfigured species is unknown to me except by the above description, which indicates a shell resembling *V. similis* and *V. trinitaria*.

Species of Haiti, Porto Rico and the Virgin Is.

63. V. DENTICULATA (Weinland). Vol. I, pl. 11, fig. 99.

Shell oblong-fusiform, thin, pellucid, hyaline-milky, sculptured with subarcuate impressed longitudinal lines. Spire regularly tapering, the apex rather obtuse, suture simple. Whorls 7, somewhat convex. Columella rather long, lightly arched forward, slightly twisted, obliquely truncate, giving off a very delicate callus. Aperture narrowly elliptical, slightly more than one-third the total length, acuminate above; peristome simple, unexpanded, arcuate in the middle and provided with a delicate tooth. Length 17, diam. 5, aperture 6×2.5 mm. (Weinl.).

Haiti: Port-au-Prince; also on the island of Gonave (Dr. Brown).

Glandina denticulata WEINL., Jahrbücher D. M. Ges. vii, 1880, p. 356, pl. 12, f. 10.—*Oleacina d.*, TRYON, Manual i, p. 27, pl. 11, f. 99.

The original description is given above, and the original figure has been copied in Vol. I. Messrs Henderson and Simpson took two varieties, as follows.

63a. Var. *charmettensis* Pilsbry, n. subsp. Pl. 19, fig. 46.

The shell is pale brown with darker streaks preceding the well-curved varices. Smooth whitish embryonic shell of $2\frac{1}{2}$ whorls; the following whorls sculptured with fine impressed lines or grooves at irregular intervals, rather close at first, but becoming widely spaced on the last whorl, where they do not extend quite to the base. There are also *short, coarse, oblique, rounded folds below the suture*, in the last four whorls. These folds are low but distinct and subregular, and hardly crenulate the suture. There are about 5 varices on the last whorl. Aperture is elliptical-ovate, vertical; outer lip is strongly arched forward, with a projecting point or small lobe at its lower third. The columella is regularly concave and very abruptly truncate. Length 19.7, diam. 6, aperture 8 mm. whorls $7\frac{3}{4}$.

Haiti: Charmettes (J. B. Henderson, Jr.).

This form differs from *V. denticulata* by its subsutural plication and larger aperture; from *V. ptychoraphe* by the strongly arcuate lip and narrower contour. The point or lobe on the outer lip is thin, as Weinland states is the case with *V. denticulata*.

A single broken shell taken by Henderson at Sans Souci, in the north, probably belongs to this subspecies.

63b. Var. GUTTIDENTATA Pilsbry, n. subsp. Pl. 19, fig. 45.

Smaller than the preceding, very glossy, with very few impressed lines besides the varices on the earlier post-embryonic whorls, and none on the later. Four or five varices on each of the last four whorls, without brown streaks. Below the suture there are traces of a very weak, oblique plication, coarse, low and irregularly developed. The outer lip is equably and moderately arched forward, and below the middle it bears a *projecting point, which is thickened drop-like inside*. Columella strongly concave and obliquely truncate. Length 16, diam. 4.9 aperture 5.9 mm.; whorls $7\frac{1}{2}$.

Haiti: La Ferrière (J. B. Henderson, Jr.).

64. V. PTYCHORAPHE (Weinland et Martens).

Shell elongate, glossy, sculptured with longitudinal impressed striæ; fleshy yellowish, ornamented with a few brown varices, two to three on each whorl. Spire long-conic, the apex obtuse; suture coronated with elevated, not close, costulae. Whorls 6, a little convex, the last tapering to the base, Aperture narrowly elliptical, two-fifths the total length; columella straightened, slightly arcuate below, abruptly truncate; outer margin unexpanded, simple, hardly curved. Length 13, diam. 5, aperture 6×3 mm. (*Martens*).

Haiti: near Jeremie (Weinland).

Glandina ptychoraphe W. & M., Malak. Bl. vi, 1859, p. 57.

Von Martens further remarks that in this species the impressed lines below the suture are much less regular and distinct than in *V. nitida* Ad., and some of them, usually every third or fourth one, are elevated into real ribs near the suture, of which 23 may be counted on the last whorl. The

bending of the outer lip, often so conspicuous in species of this group, is here represented by a weak retraction near the suture only. One example taken.

65. *V. BIPLICATA* (Weinland et Martens).

Shell elongate, thin, longitudinally closely hair-striate, silky, pale tawny, irregularly marked with narrow distant reddish streaks. Spire turrite, the apex rather acute, suture impressed. Whorls 6 ?, a trifle convex. Aperture narrowly elliptical, four-ninths the total length. Columella rather long, distinctly plicate above, the base obliquely truncate; outer margin unexpanded, acute, arcuately produced in the middle. Length 6.5 to 9, diam. 2.5 mm., aperture 2.5 to 4 mm. long, 1.5 to 2 wide. (*Martens*).

Haiti: near Jeremie (Weinland).

Glandina biplicata W. & M., Malak. Bl. vi, 1859, p. 57.—
WEINLAND, Jahrb. D. Malak. Ges. vii, 1880, p. 355.

Described from three examples, a large one with defective aperture and two small, fresh ones. Whether the large one is adult remains uncertain. The upper part of the shell closely resembles *V. ligata*, but besides the oblique basal truncation of the columella it has also a spiral fold, like *Spiraxis*.

In his later note Weinland records specimens sent by Bland from Port-au-Prince, glassy-clear and transparent, without trace of the red streaks. Possibly these are not really *V. biplicata*.

66. *V. HISTRIO* (Pfeiffer). Pl. 19, figs. 42, 43.

Shell long-fusiform, rather solid, nearly smooth, irregularly painted with streaks and flames of brown; spire long, suddenly passing into the rather acute apex; suture crenate. Whorls 8, convex, deeply plicate below the suture, the last about three-sevenths the total length, tapering basally. Columella vertical, obliquely and narrowly truncate. Aperture vertical, subrhombic-oval; peristome simple, unexpanded, the right margin slightly arched forward. Length 23, diam. below the middle nearly 8 mm. (*Pfr.*).

Haiti: Mt. Platon, 30 miles northeast from Aux Cayes (Smith).

Achatina histrio PFR., Malak. Bl. xiii, 1866, p. 85; Novit. Conch. ii, p. 300, pl. 72, figs. 17, 18.—*Glandina histrio* Pfr., CROSSE, Journ. de Conchyl. 1891, p. 97.

This rare form is known only by the original specimen. It seems related to the *V. denticulata* group in form, yet differs strikingly in coloration.

67. *V. IMPRESSA* (Pfeiffer). Pl. 18, fig. 28.

Shell oblong-turrite, thin, smooth, irregularly marked with impressed longitudinal lines, fulvous. Spire turrite, the apex rather acute; suture impressed, submarginate. Whorls $6\frac{1}{2}$, flat, the last about two-fifths the total length. Columella arcuate, abruptly truncate at the base. Aperture oblique, sinuate-oval; peristome simple, the right margin receding at the base. Length 8.5, diam. 2.66, aperture 3×1.5 mm. (Pfr.).

Haiti: around Santo Domingo City (Sallé). Also Porto Rico, St. Johns and St. Thomas.

Achatina impressa PFR., P. Z. S. 1851, p. 148; Conchyl. Cab. p. 354, pl. 29, f. 16, 17; Monogr. iii, 497.—*Subulina impressa* Pfr., CROSSE, Journ. de Conchyl. 1891, p. 151.

The original description and figures are given. In *Monographia* vi, p. 231, Pfeiffer adds the locality St. Johns, collected by Riise. From a study of the specimens before me from Haiti, Porto Rico and St. Thomas I am disposed to unite *G. terebraformis* Shuttl. as a synonym or variety, though I have not seen type or topotypes of *V. impressa*. The somewhat greater size and colored streaks of Shuttleworth's form seem to be its only distinguishing characters, and we have no evidence that Pfeiffer's type of *V. impressa* was a fully adult shell.

Var. *terebraformis* (Shuttleworth). Pl. 19, fig. 33.

Shell turrite-subulate, thin, very smooth, irregularly marked with remote impressed lines, very glossy, rufous corneous, here and there ornamented with darker or reddish streaks.

Spire long, the apex obtuse; whorls 7 to 8, rather flattened, the last scarcely one-third of the total length; suture nearly simple, rather deep. Aperture semioval, peristome simple, acute, the right margin arcuate; columella strongly arcuate, truncate at the base. Length 13, diam. 3, aperture 3×2 mm. (*Shuttlew.*).

Porto Rico: Ceiba and Rio Blanco, rare (Blauner); Vega baja (Gundlach).

Glandina terebraformis SH., Diagn. n. Moll. no. 6, p. 144, in Mittheil. Nat. Ges. Bern 1854, p. 52.—MARTENS, Jahrb. D. M. Ges. iv, 1877, p. 345.

The specimen figured is from Rio Blanco. It is a little less slender than Shuttleworth's type. There are $2\frac{1}{2}$ smooth embryonic whorls, the rest with irregularly spaced grooves, and occasional varices, three or four on the last whorl. Length 11.5, diam. 3, aperture 3.6 mm., whorls 7.

In the island of Haiti, *terebraformis* has been reported from the Sierra Monte Cristi, in Santo Domingo (Hjalmarson, Malak. Blätter v, 1858, p. 153). I have before me specimens from Cape Haitian, at the western extreme, collected by J. B. Henderson, Jr., which may be described as follows. The shell (pl. 19, fig. 34) is slender and elongate, thin, yellow with an olive tint, and some very faintly darker brownish streaks. The surface is glossy; suture with a dark margin by transparence. The pupiform embryonic shell consists of $2\frac{1}{2}$ smooth whorls, the apex obtuse. Subsequent whorls have widely and somewhat unequally spaced grooves, which are arcuate or a little sinuous. On the last whorl about 15 such grooves may be counted, 5 or 6 of them being varix-grooves. The latter extend to the base, while the inter-variceal grooves fade out at the lower third. The aperture is piriform, its length contained three times in that of the shell. The outer lip is thin, strongly arched forward, but with no trace of a projecting point such as occurs in *V. denticulata*, etc. The columella is very concave, without noticeable callus, and is abruptly truncate at the base. Length 9, diam. 2.8, length of aperture 3 mm. Whorls $6\frac{1}{2}$.

Haiti: Cape Haitian (J. B. Henderson, Jr.).

This little species has about the proportions of *V. biplicata*, but differs conspicuously from that in its sculpture of widely spaced grooves, in place of the close, hair-like striæ which give a silky luster to *biplicata*. There is, moreover, no trace of a spiral fold upon the columella.

A dead specimen in the same lot is somewhat larger, 11.4 x 3 mm., aperture 3.3 mm., with $7\frac{1}{4}$ whorls. The last two whorls are rather conspicuously flattened.

Form from St. Thomas, pl. 18, fig. 32. Dead shells which have lost color, and may not be full grown are before me. The shell is sculptured with unequal, unevenly spaced grooves after the first two smooth whorls. The aperture is piriform; the columella is very deeply concave, abruptly truncate at the base. A small false umbilicus is seen in basal view, as in *V. elata*. Length 6.8, diam. 2, length of aperture 2.3 mm.; whorls $5\frac{1}{2}$.

St. Thomas: Freydenal, and a hill opposite Baker's (T. Bland).

Achatina — ? *Sp. undet.*, BLAND in Adams' Contributions to Conchology no. 11, 1852, p. 219, no. 8 (22); no description.—“*Achatina subtilis* Shuttl.,” label in R. Swift collection.

This form differs from *V. elata* by its rather sparse, irregularly spaced grooves. It has a more concave columella than Pfeiffer figures for his *V. impressa*, and the columella is perhaps perceptibly more gyrate than in the larger *terebraformis*. I have not been able to trace the name *A. subtilis* Shuttl. to a description.

68. *V. SULCULOSA* (Shuttleworth). Pl. 19, fig. 35.

Shell turrite-subulate, thin, very smooth, closely marked with rather deep impressed lines, very glossy, pale corneous, ornamented with reddish streaks here and there. Spire long, the apex obtuse. Whorls 7, a little convex, the last nearly one-third the total length; suture nearly simple. Aperture semioval; peristome simple, acute, the right margin noticeably arcuate; columella strongly arcuate, base truncated. Length 10, diam. 2.66, aperture 3 x 2 mm. (*Shuttlew.*).

Porto Rico: San Juan and Humacao, under dead leaves, very rare (Blauner).

Glandina sulculosa SHUTTLEW., Diagn. n. Moll. no. 6, p. 144, in Mittheilungen der naturforschenden Gesellschaft in Bern 1854, p. 52.

This species is closely related to *V. terebræformis* but differs in sculpture. The first $2\frac{1}{2}$ whorls are smooth. The rest are regularly and deeply grooved, with occasional variceal grooves preceded by a wider smooth brown streak. On the last whorl there are three varices. Two specimens from near San Juan measure:

Length 8.8, diam. 2.5, aperture 3 mm., whorls $6\frac{1}{3}$.

Length 9.7, diam. 2.7, aperture 3 mm., whorls $6\frac{3}{4}$.

V. elata of Cuba resembles *V. sulculosa* in sculpture, but it has a more oblique aperture, effuse basally, and a somewhat more openly gyrate axis. In *V. sulculosa* no central hollow is seen in a basal view. In some examples the grooves are somewhat more spaced than in the typical form, approaching *V. terebræformis*.

69. *V. PORTORICENSIS* (Pfeiffer). Pl. 19, fig. 36.

Shell turrit-oblond, smoothish, irregularly sculptured with impressed longitudinal lines, glossy, ornamented with darker streaks. Spire long, somewhat obtuse; whorls 8, flattened, the last slightly more than one-third the total length. Columella arching forward, abruptly truncated at the base of the aperture. Aperture elliptical-semioval; peristome simple. Length 20, diam. 7, aperture 8×3.3 mm. (*Pfr.*).

Porto Rico: San Juan (type loc.), Hamacao and Luquillo (Blauner); Aguadilla, Quebradillas and Vega baja (Gundlach).

Achatina portoricensis PFR., P. Z. S. 1848, p. 111; Monogr. ii, p. 258.—*Glandina p.*, SHUTTLEW., Diagnosen no. 6, p. 144.—MARTENS, Jahrb. D. M. Ges. iv, p. 345, 1877.—CROSSE, Journ. de Conchyl. 1892, p. 10.—*Achatina riisei* PFR., Zeitschr. f. Malak. 1852, p. 151; Monogr. iii, p. 509; Conchyl. Cab. p. 370 pl. 67, f. 3, 4.

The first $2\frac{3}{4}$ whorls are smooth. All the rest are irregu-

larly sculptured with unequally spaced grooves, with occasional varices preceded by brownish streaks. The later whorls have some low fine ripples between the grooves. The varices and outer lip are but very slightly arcuate. The ground color is more or less distinctly yellow. A well grown example measures length 21.7, diam. 6.2, aperture 7.5 mm., whorls 8.

A. riisei Pfr. was based, as Pfeiffer himself has stated, on the same specimen earlier described as *portoricensis*.

70. *V. CORUSCA* (Reeve). Pl. 11, fig. 56.

"Shell pyramidal, somewhat fusiform, obtuse at the apex, whorls seven in number, convex, smooth, polished, finely margined at the sutures, columella arched and twisted, aperture ovate; transparent brown, glassy, obscurely stained with flexuous chestnut streaks." (Reeve).

Habitat unknown.

Achatina corusca REEVE, Conch. Icon. v, pl. 22, f. 121 (March, 1850).

"A shell of firm growth though transparent and glossy" Pfeiffer, in the *Nomenclator Heliceorum* places this dubious and ill-described form in *Subulina*, but it looks more like *Varicella impressa* or *V. portoricensis*. The figure, copied on plate 11, is stated to be "considerably magnified."

Section *Lavaricella* Pilsbry, n. sect.

Varicellas without distinct grooves or striæ between the varices. Embryonic shell pupiform (except in *V. glabra*), of 3 to $3\frac{1}{2}$ smooth whorls; columella very concave and abruptly truncate. Type *V. semitarum*.

I. Embryonic whorls forming a pupiform apex.

- a. Length of shell about 4 times that of the aperture; pale greenish, yellowish or brownish, sometimes with inconspicuous brown varix-streaks.

b. 28×6.5 mm., whorls 10; Martinique.

V. semitarum, no. 71.

b¹. 16×4 mm., whorls 7; Dominica.

V. perlucens, no. 72.

- a*¹. Length of shell not much over 3 times that of aperture; greenish corneous usually with continuous chestnut stripes; 14 x 4.3 mm., whorls 7, Guadeloupe.

V. guadeloupensis, no. 73.

- a*². Aperture more than one-third the length of shell; corneous or yellowish with chestnut streaks cut by peripheral and subperipheral pale belts; 27 x 9 mm., with 7½ whorls; Porto Rico.

V. interrupta, no. 74.

- II. Embryonic shell forming an obtusely conic apex; corneous or yellow with some chestnut streaks; length 23 to 33, diam. about 12 mm., with 7 to 8½ whorls; Porto Rico.

V. glabra, no. 75.

71. *V. SEMITARUM* ('Rang' Pfr.). Pl. 5, figs. 7, 8.

Shell subulate, the apex obtuse, pale corneous, longitudinally substriate, glossy; whorls 10, nearly flat, the last scarcely exceeding one-fourth the total length. Columella strongly arcuate, obliquely truncate at the base of the aperture. Aperture oblong-acuminate, wide at the base; peristome simple, the right margin somewhat arched forward. Length 28, diam. 6.5, aperture 7 x 4 mm. (*Pfr.*).

Martinique: Slopes of Mont Pelée (Beau); Massif des Pitons near Camp Balata, 500-610 meters elevation (Maze).

Helix semitarum Rang in Paris Museum.—*Achatina semitarum* Rang PFR., Symbolæ ii, p. 59 (1842); Monogr. ii, p. 263. Conchyl. Cab. p. 333, pl. 28, f. 10, 11.—REEVE, Conch. Icon. v, pl. 16, f. 73.—FISCHER, Journ. de Conchyl. vii, 1858, p. 185, pl. 7, f. 4, 5.—*Glandina semitarum* MAZE, Journ. de Conchyl. 1874, p. 159.—BINNEY, Ann. N. Y. Acad. Sci. iii, p. 81, pl. 17, f. C (teeth).—*Achatina sylvatica* PFR., Monogr. ii, p. 262, exclusive of references.

The shell has a greenish-corneous tint and an oily or varnish-like gloss. Very faint traces of fine spiral striæ may be seen under the lens, and there are occasional impressed lines or varix-grooves marking former resting positions. The first 3½ whorls are smooth, without these varix-grooves, but on the rest there are about three of them on a

whorl, at unequal intervals, in the shell drawn in fig. 7. In some others the varix-grooves are less numerous.

Fischer states that fresh shells are uniform yellowish-corneous with a reddish summit and a reddish line along the suture. There is also a form with brown flames behind the varix-grooves, fig. 8.

72. V. PERLUCENS (Guppy).

"A subulate-turrite, smooth, brilliantly polished, yellowish-red shell, marked by obscure striae and by distant variciform lines, of which there are from three to six on a whorl; with a very obtuse apex and seven slowly increasing, scarcely convex whorls, the last somewhat flattened and equal to about half the length of the shell; columella strongly curved, truncate; aperture oval, elongate; peristome simple, its external margin somewhat prominent. A species allied to *G. arcuata* Pf. of Jamaica. Of three examples I obtained, one only was of full growth. Length 16, diam. 4, aperture 4 x 2 mm." (Guppy).

Dominica (Guppy).

Glandina perlucens GUPPY, Ann. and Mag. Nat. Hist. (4 ser.), i, 1868, p. 430.

A little-known form, not yet figured, and apparently related to the preceding. Only the original lot is known.

73. V. GUADELOUPENSIS (Pfeiffer). Pl. 19, figs. 40, 41.

Shell oblong-turrite, thin, smooth, very glossy, pellucid, greenish-corneous, with occasional arcuate varices, not very prominent and bordered with chestnut. Spire regularly tapering, the apex obtuse. Whorls 7, a little convex, the last about one-third the length, tapering basally. Columella very much arched, the base narrowly truncate. Aperture slightly oblique, acuminate-oval; peristome thin, the right margin arching forward, rufous-margined. Length 14, diam. 4.33, aperture 4.66 x 2.5 mm. (*Pfr.*).

Guadeloupe: Gommier (Cailliet, type in Mus. Cuming); Baillif, Mt. St. Louis, Bouillante, Saint-Claude along the ravine Malanga (Marie), under stones and vegetable debris, in damp shady places, always above 300 meters elevation.

Achatina guadeloupensis PFR., P. Z. S. 1856, p. 335.—*Oleacina guadeloupensis* PFR., Monogr. iv, p. 630.—*Glandina* g., MAZE, Journ. de Conchyl. xxxi, 1883, p. 9, pl. 1, f. 3.

Mazé, to whom we owe figures of this species, states that Marie found a specimen without dark streaks (fig. 40). I have not seen the species, which appears to be related to *V. semitarum*.

74. *V. INTERRUPTA* (Shuttleworth). Pl. 19, fig. 39.

Shell fusiform, thin, very smooth, and glossy, corneous, ornamented with rather wide and unevenly spaced reddish-chestnut streaks, on the last whorl intersected at the periphery by a conspicuous whitish zone, and another narrower one on the base. Spire somewhat acuminate, the apex very obtuse. Whorls $7\frac{1}{2}$, a little convex, the last three-sevenths the total length; suture narrowly margined, slightly plicate. Aperture narrow, acuminate semi-oblong; peristome simple, acute, the right margin inconspicuously arcuate; columella oblique, very deeply arcuate, truncate at the base. Length 27, diam. 9, aperture 11×4 mm. (*Shuttl.*)

Porto Rico: Luquillo, under fallen leaves (Blauner); Yunque de Luquillo (Sintensis).

Glandina interrupta SH., Diagn. no. 6, p. 144, in Mittheil. nat. Ges. Bern 1854, p. 52.—MARTENS, Nachrbl. D. M. Ges. 1891, p. 131.

The embryonic shell is pupiform and consists of 3 smooth whorls, terminating with a brown streak and varix-line. Subsequent whorls have fine, inconspicuous growth ripples between the varices. This fine species resembles *V. glabra* in sculpture, but differs by its slender, attenuate spire, with embryonic shell of a very different shape.

Group of *V. glabra*.

The oblong shell is rather large, *Oleacina*-like, smooth and glossy, with an obtuse conic embryonic shell of $3\frac{1}{3}$ whorls. This form resembles *Oleacina* in general appearance and in the conic embryonic shell, but it also seems closely related to *V. interrupta*, which by its pupiform embryonic whorls re-

sembles the other Porto Rican Varicellas and the *Semitarum* group. Until we know much more of the soft anatomy of these groups, we are in no position to decide upon the affinities of aberrant or connecting forms. Whether *glabra* is nearer to *Varicella* or to *Oleacina* remains to be determined.

75. V. GLABRA (Pfeiffer). Pl. 19, figs. 37, 38.

Manual Vol. I, p. 23.

This fine species varies widely in shape, and several races may possibly be recognized when sufficient material with locality data is available. Shuttleworth however reports the slender form (*var. gracilior*) as found with the typical at Luquillo and San Juan. Two examples figured measure as follows:

Length 30.2, diam. 12, apert. 15.8 mm., whorls $7\frac{1}{2}$ (Luquillo).

Length 33.2, diam. 11.5, apert. 15 mm., whorls $8\frac{1}{3}$ (Humacao).

The latter (fig. 37) is the variety *gracilior*, a name pre-occupied by Adams. Shells even shorter than fig. 38 occur, one measuring 22.7 x 12.3, aperture 15.25 mm., with 7 whorls.

The egg capsules of the slender form (pl. 19, fig. 44) are elliptical with slightly pointed ends, 6.5 x 3.6 mm., with a hard white shell covered with a raised network pattern of interrupted lines, which do not quite reach one pole.

The embryonic shell of $3\frac{1}{3}$ smooth whorls forms a conic, rapidly enlarging summit, very unlike that of all other Porto Rican Varicellas, and shaped more like the apex of an *Oleacina*, or of *Varicella leucozonias*.

Genus OLEACINA Bolten.

Oleacina BOLTEN, Museum Boltenianum, p. 110 (1798), type and sole species *O. volutata* Bolt. = *O. voluta* Gm.

Polyphemus MONTFORT, Conchyliologie Systématique, ii, p. 414 (1810), type and sole species *P. glans* = *O. voluta flexuosa*.

Glandina SCHUMACHER, Essai d'un nouveau Système des

habitations des Vers Testacés, pp. 61, 202 (1817), type and sole species *G. olivacea* Schum., = *O. voluta* Gm.

Boltenia PFEIFFER, Nomenclator Heliceorum Viventium p. 7, 1881, based on the types of *Oleacina* Bolten and *Glandina* Schum.; first species *O. voluta*.

Shell oblong or fusiform-oblong, smooth or smoothish, olivaceous or yellow, usually with long last whorl and short spire; embryonic whorls smooth; aperture long and very narrow above; columella concave, abruptly truncate at base; outer lip simple, arched forward in the middle.

Type *O. voluta* (Gm.). Distribution, Haiti and Cuba.

While it is almost impossible to frame differential conchological definitions of *Oleacina*, *Varicella* and *Euglandina*, yet the general aspect of the shells is characteristic; the genera are apparently valid, and their recognition is necessary to a clear idea of the relationships of the species. One species of *Oleacina* is striate, *O. voluta*; several Haitian forms have varix-grooves, showing thereby a relationship to *Varicella* and especially to Porto Rican species of the section *Lævaricella*. The soft anatomy is as yet insufficiently known, but data on various forms may be found in the preface to this volume.

The references given above show that the name *Glandina*, long in common use, is an absolute synonym of *Oleacina*. *Boltenia* was proposed by Pfeiffer for the typical section of *Oleacina*, and was expressly said by him to be equivalent to typical *Oleacina* and *Glandina*; therefore these names cannot be used for Mexican or European forms or for the *O. oleacea* group, as some authors have done.

Sections of Oleacina.

OLEACINA s. str. Shell large, solid and opaque, the surface finely, evenly striate. Type *O. voluta*.

LÆVOLEACINA n. sect. Shell rather thin, yellow, very glossy, smooth or with a few grooves. Type *O. oleacea straminea*.

Key to Haitian species of Oleacina.

- a.* Shell large, about 50 to 60 mm. long, olivaceous, solid and opaque, densely, finely striate. *O. voluta*, no. 1.
- a*¹. Shell much smaller, yellowish, thin.
 - b.* Shell sinistral, about 15 mm. long. *O. paivana*, no. 7.
 - b*¹. Shell dextral.
 - c.* Nearly smooth; whorls almost regularly increasing.
 - d.* Outlines of the spire slightly convex.
 - e.* Length about 20 mm.
 - O. mulleri*, no. 2.
 - e*¹. Length less than 17 mm.
 - O. smithiana*, no. 3.
 - d*¹. Outlines of the spire straight.
 - O. pethionis*, no. 4.
 - c*¹. Surface grooved at irregular intervals; whorls progressively more rapidly widening, the last suture more oblique.
 - d.* Length 11 to 12 mm., about three times the diameter. *O. cleriei*, no. 5.
 - d*¹. Length 8 to 9 mm., more than three times the diameter. *O. microlestes*, no. 6.

Section OLEACINA s. str.

1. *O. VOLUTA* (Gmelin). Pl. 31, figs. 15, 16.

The shell is solid but not thick, somewhat *Conus*-shaped, widest at the shoulder, the sides convexly tapering to the base, spire conic with straight sides and very obtuse apex. The shell is of a rather pale, dull violet-rose color, with a white band below the suture and whitish near the base, under an olivaceous cuticle, which is almost entirely wanting in the example figured (fig. 16). The surface appears smooth to the eye, but under a lens it is seen to be rather deeply and regularly striate below the suture (fig. 15), the striae rapidly weakening to irregular growth-wrinkles below the shoulder of the last whorl. The first 2½ whorls are smooth in the examples seen, which may, however, be some-

what worn. The suture is somewhat uneven, but is not crenulated by the striæ. The aperture is very long and narrow, outer lip acute, pale near the edge, straightened in the middle. Columella short, quite concave, abruptly truncate. Length 49.5, diam. 21, length of aperture 36 mm.; whorls $7\frac{1}{3}$.

Haiti: Miragoane (H. Rolle).

Bulla voluta, *testa cylindracea lævis*, *ex oleacino*, etc., CHEMNITZ, Conchyl. Cab., ix, pt. 2, p. 16, pl. 117, f. 1009, 1010 (1786).—*Bulla voluta* GMEL., Syst. Nat. (13), p. 3433, no. 40, (1790), based on above reference.—*Achatina voluta* Chemn., PFR., Monogr. Hel. Viv., ii, p. 279; Conchyl. Cab., p. 297, pl. 7, f. 4, 5.—REEVE, C. Icon., vii, fig. 55.—*Oleacina voluta* Chemn., PFR., Nomencl. Hel. Viv., p. 8.—TRYON, Manual, i, p. 22.—*Glandina voluta* Chemn., CROSSE, Journ. de Conchyl., 1891, p. 99, pl. 1, f. 1.—*Bulimus glans* BRUG., Encycl. Méth., p. 365, no. 111 (1792).—*Glandina olivacea* SCHUMACKER, Essai d'un nouv. Syst. test. Vers, p. 202 (1817), based on *Bulla voluta* Chemn.—*Oleacina volutata* BOLTEN, Museum Boltenianum, p. 110, no. 1411, 1798, based on *Bulla voluta* Gmel. and Chemnitz.

This species is the type of the genus *Oleacina*. Like various other Haitian land shells, it is an isolated form without near relatives. The striate surface and dark color are features not found in other Antillean Oleacinas; yet the general aspect of the shell, and particularly the shape of the aperture, are so different from any of the mainland Euglandinas that I do not believe that *O. voluta* is congeneric with the Mexican species.

The figures on pl. 31 represent a shell from Miragoane in coll. T. H. Aldrich. It is probably not quite mature. The various specimens I have seen and the published figures of *O. voluta* and *O. flexuosa* show these forms to vary widely in size and contour, and it seems likely that all belong to one species, represented perhaps by a number of local races.

1a. *O. VOLUTA* var. *FLEXUOSA* (Pfeiffer). Pl. 31, fig. 14.

See vol. I, p. 33, pl. 5, fig. 68, copied from Pfeiffer's type figure. The type measured: length 53, diam. 20, length of

aperture 30 mm.; whorls 7. The habitat was unknown. (*Achatina flexuosa* PFR., P. Z. S. 1854, p. 150; Novit. Conch., i, p. 9, pl. 3, f. 16, 17.—*Oleacina f.*, PFR., Monogr., iv, 639; vi, 278.—BLAND, Ann. N. Y. Lyc. Nat. Hist., xi, p. 72.—*Glandina f.*, CROSSE, J. de Conch. 1891, p. 98.)

A large specimen from Aux Cayes, Haiti, is figured. It measures, length 63.5, diam. 25.2, length of aperture 39.5 mm., with $7\frac{1}{2}$ whorls, and is the same shell noticed by Bland (*l. c.*). It is more fusiform than *O. voluta*, with a more oblique aperture, that of *voluta* being subvertical; the striation is perceptibly coarser, and extends nearly to the base. The aperture is shorter, and the outer lip more inflexed and more sinuous, being arched forward in the middle. Under the cuticle it is violaceous reddish, paler and whitish near the gray-margined suture, and white at the base and behind the outer lip. The cuticle is olivaceous-tawny, with occasional darker reddish or olive streaks.

This large form of *flexuosa* is apparently what Montfort figured as *Polyphemus glans* (Conch. Syst., ii, p. 414).

Section LÆVOLEACINA Pilsbry, n. sect.

Lævoleacina PILS., *antea*, p. 128 (August 31, 1907).—*Boltenia* PFEIFFER (in part), and of some other authors, not *Boltenia* SAVIGNY, 1828 (Ascidians).

Shell oleacinoid, covered with a very smooth and very glossy yellowish or greenish-yellow cuticle; sculpture of longitudinal grooves, which are usually very weak and few. Columella abruptly truncate at base. Type *O. oleacea straminea*.

Distribution: Haiti, Cuba, Isle of Pines, New Providence, Bahamas.

All Haitian species of *Lævoleacina* are described below, since the account of them in Vol. I was very incomplete.

Several of the small Cuban species are but slightly differentiated, and are often hard to determine. The contour of the shell and the comparative length of the aperture undergo remarkable changes with age, as shown in the illustrations of *O. cleriei*. There seems to be considerable individual varia-

ation, as well as the usual local variation; so that the problems presented by these miniature Oleacinas are exceptionally difficult.

2. *O. MULLERI* Maltzan. Pl. 32, figs. 17, 18.

"Shell ovate, very glossy, under the lens very lightly striate, subtranslucent, greenish brown. Whorls 6 to 7, very slightly convex, separated by a lightly brown-margined suture, which descends more rapidly from the antepenultimate whorl; last whorl three-fifths the total length, rounded at base. Aperture irregularly ovate, narrow, rounded basally; peristome acute, bending forward in the middle; columella contorted and abruptly truncate at the base; parietal wall covered with a very thin but distinct callus. Alt. 20, diam. 8, aperture 12 mm." (*Maltzan*).

Haiti: Sans-souci (H. Rolle, J. B. Henderson); La Ferrière and Charmettes (Henderson and Simpson); San Cristobal, Rep. Santo Domingo (A. Sallé); (?) Cibao (Hjalmarson); also Santo Domingo (Gabb).

Oleacina mülleri MALTZAN, Nachrbl. d. d. Malak. Ges., xx, 1888, p. 179.—*Streptostyla mülleri* Maltz., CROSSE, Journ. de Conchyl. 1891, p. 101, pl. 1, f. 2.—(?) *Oleacina oleacea* Fér., HJALMARSON and PFR., Mal. Bl., v, 1858, p. 153.—*Glandina oleacea* Fér., CROSSE, Journ. de Conchyl. 1891, p. 99.

A smaller, more regularly fusiform species than the Cuban *O. straminea*, with strictly conic spire, less concave columella, and yellow instead of reddish streaks. The aperture is narrower at and above the middle, the outer lip more distinctly arching forward in the middle, and having a smooth, obtuse edge, not so thin and acute as it usually is in *O. straminea*. A considerable series before me, collected by Sallé, Gabb, Henderson and Simpson, shows this form to be quite constant. The description of Maltzan is imperfect in several details. The color of fresh specimens is greenish yellow, with irregularly spaced olive-yellow streaks. The suture has a pale border, edged with gray below. The aperture is not "ovate," but rather lanceolate, and the outer lip is strongly retracted above the middle. The whorls increase regularly to the last,

which descends much more rapidly. Adult specimens from La Ferrière *a*, Charmettes *b*, and Santo Domingo *c*, measure:

- a*. Length 21.3, diam. 8, aperture 12 mm.; whorls $6\frac{1}{2}$.
- b*. Length 19, diam. 7.25, aperture 11 mm.; whorls $6\frac{1}{3}$.
- c*. Length 20, diam. 8, aperture 12 mm.; whorls 6.

Specimens collected by Sallé, and hitherto reported as *O. oleacea*, prove to be *O. mülleri*. The true *O. oleacea* has not yet been found in Haiti. There is some doubt about what the original *oleacea* really was; the figure has a suspicious resemblance to *O. mülleri*, yet it is larger than any Haitian specimen actually known, and, according to Deshayes' description, it had more whorls.

3. *O. SMITHIANA* Pfeiffer.

Shell subfusiform-cylindric, rather solid, smooth, glossy; bluish-white, marked sparsely with fulvous streaks. Spire convexly conic, the apex obtuse, suture slightly impressed, broadly margined. Whorls 6, but slightly convex, the last forming nearly two-thirds the length, slightly tapering basally. Columella arcuate, abruptly truncate above the base of the aperture. Aperture vertical, acuminate above, rounded basally, pearly inside; peristome simple, unexpanded, the right margin lightly arched forward. Length 16.5, diam. 5.66, aperture 11×2.5 mm. (*Pfr.*).

Haiti: Mt. Platon (Smith, type loc.); environs of Jeremie and Gonave Island (Weinland); Port-au-Prince (Dr. Brown).

Oleacina smithiana PFR., Malak. Bl., xiii, 1866, p. 85.—(?) *Glandina s.*, WEINLAND, Jahrb. D. M. Ges., vii, 1880, p. 356.

This species has not been figured. Whether the shells commented on by Weinland, from Jeremie, Port-au-Prince and Gonave Island are identical with Pfeiffer's type remains uncertain. The type locality, Mt. Platon, is about thirty miles northeast of the Haitian town Les Cayes.

3a. Var. *SIMPSONI* Pilsbry, n. v. Pl. 32, figs. 20, 21.

The cylindric-fusiform shell is decidedly smaller than *O. smithiana*, smooth except for faint growth-lines; suture margined with a whitish followed by a gray line, the last whorl

more rapidly descending. Outer lip obtuse, well arched forward in the middle. Length 14, diam. 5.2, aperture 8 mm.; whorls $5\frac{1}{2}$.

Haiti: St. Mark (Henderson and Simpson); Santo Domingo (W. M. Gabb).

This is probably the form reported by Weinland.

4. *O. PETHIONIS* (Weinland).

Vol. I, p. 23, pl. 11, fig. 83. This species is larger than *O. smithiana*, and distinguished especially by the conic, straight-sided spire. Length 22, length of aperture 14 mm., whorls 7.

Haiti: Port-au-Prince (Weinland).

Glandina pethionis WEINL., Jahrb. D. M. Ges., vii, 1880, p. 355, pl. 12, fig. 9.

Named for the mulatto President Pethion.

A mutilated specimen of a form evidently close to *pethionis* was found by Mr. Henderson at Port-au-Prince. It has the spire more slender than in Weinland's figure, its sides slightly concave, and the last whorl tapers more to the base. It has somewhat the appearance of a high-spined *Conus*. The sculpture is like that of *O. cleriei*—irregularly grooved, and the aperture is quite narrow. It measures 17 x 6.5 mm., with $7\frac{1}{2}$ whorls.

5. *O. CLERIEI* (Weinland). Pl. 32, figs. 19, 23, 24, 25, 26.

Vol. I, p. 25. Specimens taken by Mr. Henderson at Jeremie, the type locality, agree with Weinland's brief description and his figures in general characters, but he does not seem to have noticed the sculpture.

The thin shell is yellow, with occasional darker olive-yellow streaks. The spire is *conic above*, the outlines becoming strongly convex below in adult shells. The first whorl is smooth, *enlarging very rapidly*; the second whorl then *becomes much narrower*, and its last half is striate (fig. 19). The following whorls enlarge at a rapidly increasing rate. They have rather *deep vertical grooves* or furrows at irregular but rather close intervals. These grooves become less deep and rarer on the last whorl in adult shells. The lip curves rather strongly forward.

Length 11.2, diam. 3.9, aperture 5.9 mm., whorls 5 (fig. 25).

Length 12, diam. 4, aperture 5 mm., whorls $6\frac{1}{2}$ (fig. 26).

Haiti: Jeremie (Weinland, Henderson).

Glandina (Oleacina) cleriei WEINL., Malak. Bl., xxiii, 1876, p. 170, pl. 2, f. 5, 5a, 6.

The rapidly accelerated descent of the suture after the third whorl changes the shape of the shell, so that the addition of a half whorl gives it quite a different appearance. I have therefore figured a series of shells from the Henderson collection, taken at Jeremie, measuring 8.5, 10, 11.2 and 12 mm. long. This species and the next are remarkable for their grooved surfaces, like *Varicella*. In *O. cleriei* the second whorl is distorted much more than in *O. microlestes*.

6. *O. MICROLESTES* Pilsbry, n. sp. Pl. 32, fig. 22.

The shell is small, lanceolate-fusiform, glossy, pale corneous-yellow with occasional narrow darker streaks (but the type specimens are bleached). The outlines of the spire are slightly convex, becoming straight near the rather large, obtuse apex. The first $1\frac{1}{2}$ whorls are smooth and enlarge rapidly; then the whorl becomes slightly narrower for a short distance, after which it enlarges, at first slowly, but with increasing rapidity, the suture becoming progressively more oblique. The suture is broadly margined by transparence and is quite irregular. The surface is marked with arcuate growth-lines and has occasional impressed grooves marking growth-stages. The thin outer lip curves well forward in the middle. The columella is rather strongly concave, and is abruptly truncate at base. Parietal callus thin but distinct.

Length 8.9, diam. 2.5, aperture 3.9 mm.; whorls $5\frac{1}{2}$.

Haiti: Port-au-Prince, and eight miles westward type loc. (Henderson and Simpson).

Glandina (Oleacina subulata) Pfr., WEINLAND, Jahrb. D. M. Ges., vii, 1880, p. 355.—CROSSE, Journ. de Conchyl., 1891, p. 100. Not *O. subulata* Pfr.

This species is smaller and more slender than *O. cleriei* or the Cuban *O. subulata*, and is doubtless distinct from both. The specimens from Port-au-Prince are a trifle smaller than

the types—length 8 mm. with $5\frac{1}{2}$ whorls—and the aperture seems a little less enlarged below. The curvature of the columella varies, but it seems always to be quite abruptly truncated.

7. *O. PAIVANA* Pfeiffer. Pl. 32, fig. 27.

One of the original lot, here figured, is more slender than Pfeiffer's type. The first $1\frac{1}{2}$ whorls are smooth and enlarge very rapidly, forming a bulbous apex. The following whorl is narrower, and sculptured with vertical grooves at unequal intervals. The following whorls have the same sculpture and enlarge slowly to the last, where the suture descends very rapidly. The last whorl is widest at the shoulder, tapering thence towards the base. The specimen is bleached, but on the white ground shows reddish streaks behind the variceal grooves, and behind the lip the whole surface is reddish. The aperture is extremely narrow, hardly widened basally. The outer lip arches strongly forward, and recedes conspicuously towards the base. The columella is slightly concave close to the abrupt truncation. Length 14.75, diam. 3.5, aperture 7.5 mm.; whorls 7. The shell is fully adult.

Pfeiffer's type measured: length 15, diam. 4, aperture 8.66 mm.; whorls 7 to 8.

Haiti: Mt. Platon, about 30 miles northeast of Aux Cayes.

Oleacina paivana PFR., Malak. Bl., xiii, 1866, p. 86; Novit. Conch., iii, p. 332, pl. 77, f. 18, 19.—TRYON, Man. Conch., i, p. 25, pl. 4, f. 52 (copied from Pfr.).

Though very distinct by its narrow mouth and sinistral coil, this species is related to *O. cleriei* and *O. microlestes* by its sculpture, like that of *Varicella*.

8. *O. OLEACEA* (Deshayes). Pl. 33, figs. 10, 11.

"Shell ovate-oblong, smooth, diaphanous, greenish; the apex acute; aperture narrow, as long as the spire. Whorls 8, a little convex; columella deeply twisted at base, compressed, white; outer lip sinuate. Length 18 to 30 mm.

"M. de Férussac having given nothing but the name of this species, without a figure or description, it would have been

impossible to recognize it but for the kindness of M. Marmin, who had determined an individual in his collection from that of Férussac. It has nearly the shape and color of an olive; it is oval, pointed, smooth, polished and glossy, of a yellowish-green throughout. Some flammules of obscure yellow are seen on the last whorl near the aperture, of which they are the former traces. The spire is pointed, conic, composed of 8 slightly convex whorls, of which the last is longer, or at least as long, as all the others. The aperture is nearly vertical, narrow, especially posteriorly. The columella is strongly twisted below, at the anterior third of its length. It is appressed to the base and becomes white. The right lip is thin and sinuous. It is supposed that this species comes from the Antilles" (*Desh.*).

The type figure measures: length 27, diam. 10.5 mm.

Achatina oleacea DESH., Encycl. Méth., ii, p. 11 (1830); Magasin de Zoologie, Mollusques, p. 3, pl. 3, f. 1, 2 (1830).—*Helix (Cochlicopa) oleacea* FÉRUSAC, Tabl. Syst., p. 50, no. 360 (nude name).

Deshayes' original description is translated above, and his original figures are copied on pl. 33, figs. 10, 11. The specimen he selected for the figure is intermediate in size between the extremes, 18 to 30 mm., mentioned in his description, the figure measuring 27 mm. long. It is likely that the measurements 18 to 30 mm. include more than one species or variety; but the specimen figured by Deshayes must be considered his type. The general shape of the shell and the narrow aperture, in this figure, as well as the yellowish green color, are strongly suggestive of the Haitian *O. mülleri*; yet that species, of which I have seen a considerable number of examples, is not known to attain nearly to the size of Deshayes' figured type. The white columella and the obscure yellow growth-arrest streaks behind the lip are also suggestive of the Haitian shell. In the Cuban form the streaks are more reddish, the columella hardly noticeably white, and the general shape is more cylindric, the spire less strictly conic, etc.

It is therefore quite possible that the type of *O. oleacea* is a Haitian shell closely related to *O. mülleri*, but larger, with

more whorls. No such shell is now known from Haiti. If not Haitian, then *oleacea* must have been based on Cuban shells. In Cuba, the form from Matanzas approaches most closely to the requirements of Deshayes' description and figure.

Pending a decision as to the identity of *O. oleacea*, we may consider the Cuban shells a subspecies, since they differ in various respects from the type figures of *oleacea*.

Cuban species of Lævoleacina.

A few Cuban species are here figured and described to fix definitely the identity of the forms I have dissected, and of the type-species of *Lævoleacina*.

8a. *O. OLEACEA* var. *STRAMINEA* (Deshayes). Pl. 33, figs. 5-9.

The shell is oblong-cylindric, thin, greenish-yellow, with arcuate, irregularly-spaced reddish streaks; very smooth and glossy, without microscopic spiral striæ. Spire conic, with slightly convex outlines and obtuse apex. Whorls regularly increasing; the suture descends regularly and is not noticeably more oblique at the last half-whorl. It is margined by transparence, and in old shells the last whorl may have an impressed marginating line. The outer lip is *very thin and sharp*, well curved forward in the middle. The short columella is very concave, colored like the shell except for a pale edge, and abruptly truncate at the base. Deshayes' figured type measured 37 x 13 mm.

Length 38, diam. 13.2, apert. 21 mm.; whorls 8. Cuba.

Length 38.3, diam. 13, apert. 20.5 mm.; whorls $7\frac{1}{2}$. Cuba.

Length 38.2, diam. 13.6, apert. 21 mm.; whorls $7\frac{1}{2}$. San José.

Length 35, diam. 12, apert. 18.5 mm.; whorls $7\frac{1}{2}$. San José.

Length 32, diam. 12.2, apert. 18.5 mm.; whorls 7. San José.

Cuba: San José (Swift coll.); Havana province at Marianao (Rhoads), La Salud (Pilsbry); Matanzas province, on the hills around Matanzas and the Yumuri valley (Pilsbry); Santa Clara province, at Cienfuegos, Cayo Carenas in Cienfuegos Bay, Sancti Spiritus, and Zaza del Medio (Pilsbry);

also numerous localities in Pinar del Rio and Santiago provinces (Arango, p. 95).

Achatina straminea DESH. in Fér., Hist. Nat. Moll. Terr. et Fluv., ii, p. 172, pl. 123, f. 11, 12 (1851).—*Oleacina oleacea* var. *straminea* Dh., PFR., Novit. Conch., p. 318, pl. 77, f. 3, 4 (Rangel).—*Achatina oleacea* Fér., ORB., Hist. Cuba, v. Moluscos, p. 87; French edit., p. 165.—PFR., Monogr., ii, p. 280; vi, 271.—DESHAYES, in Fér., Hist., p. 172, pl. 123, f. 5, 6.—*Glandina o.*, PHILIPPI, Abbild., i, p. 131, pl. 1, f. 1, and of other authors.—*Oleacina oleacea* ARANGO, Fauna Malac. Cubana, p. 95.

Deshayes' type of *straminea* measured 37 x 13 mm.; its locality was unknown, but the measurements and figures correspond exactly with large specimens before me from San José, in Pinar del Rio, one of which is figured, pl. 33, fig. 8. Pfeiffer also figured a very large specimen, 42 mm. long, from Rangel, in northern Pinar del Rio; his figure was copied by Tryon, Vol. I, pl. 4, f. 45.

Considerable series I collected in Havana, Matanzas and Santa Clara provinces consist of smaller shells, such as have ordinarily been called *oleacea*. One from Matanzas is figured (pl. 33, fig. 7), agreeing pretty closely with typical *oleacea* in size, but still differing by its wider mouth. It measures, length 27.25, diam. 10.5, aperture 16.3 mm., whorls $6\frac{1}{2}$. Others from near Matanzas measure 29 x 10, ap. 15.5 mm., and 28.5 x 10, ap. 16 mm. At Cienfuegos they are similar but a little larger—length 32-33 mm. I found an obese form with strongly concave columella in Cayo Carenas, in Cienfuegos Bay (pl. 33, fig. 9), length 30, diam. 11.5, ap. 17 mm.

Near Sancti Spiritus, in the group of white limestone "rocks of San José," the shells are markedly cylindric, with full, saccate base and extremely concave columella (pl. 33, figs. 5, 6). Were it not that the animal is colored like *O. oleacea straminea*, I would consider these a small race of *O. cyanozoaria*.

In the collection of J. B. Henderson there is a very small, rather dark-chestnut-tinted form from the Isle of Pines, 19 x 8 mm., $5\frac{3}{4}$ whorls.

9. *O. CYANOZOARIA* 'Gundl.' Pfr.

Vol. I, p. 22. This species often attains a larger size than *O. o. straminea* in the same region, though not larger than some *straminea* from the Organ Mts. The last whorl has a narrow, convex margin, sharply and very finely striated across, below the suture; this margin is generally defined by a furrow. The columella is very deeply concave, but some *straminea* have it equally so. It reaches a length of 35 to 42 mm.

Cuba: mountains of Trinidad, at San Juan de Letran (Gundlach, 1856), and on the northwestern slope of La Vigia (Pilsbry, 1904).

Oleacina cyanozoaria Gundl., PFR., Malak. Bl., iv, p. 108, 1857; Novit. Conch., p. 317, pl. 77, f. 1, 2.

I could not find this snail at San Juan de Letran in 1904, but took specimens on the mountain La Vigia, where adults are 35 to 36 mm. long. Gundlach's other locality, "Sitio Quemado," is unknown to present residents of the region. The type measured 40 x 13.3 mm. The largest shell before me measures, length 42.5, diam. 14.5, aperture 24 mm.

10. *O. SOLIDULA* (Pfeiffer). Pl. 33, figs. 3, 4.

The figures show a specimen which supplied the anatomical figures on plates 35, 36, taken from under an old tie in the yard of the Tunas and Sancti Spiritus Railway, in Sancti Spiritus. It measures, length 13.4, diam. 5, aperture 7 mm., with $5\frac{1}{2}$ whorls. The earlier whorls increase slowly and regularly, the last $1\frac{1}{3}$ descend more rapidly.

The species is found over a large part of Cuba, though not everywhere. Neither Gundlach nor I found it around Trinidad, but it was taken everywhere else I collected in Havana, Matanzas, Santa Clara, and Puerto Principe Provinces. Specimens are also before me from Pinar del Rio and Santiago Provinces, and the Isle of Pines. It is a common species at Nassau, New Providence, where I regard it as probably introduced from Cuba, together with various other Cuban snails. The type locality is Matanzas.

Polyphemus solidulus PFR., Archiv für Naturg. 1840, i, p.

252.—*Achatina solidula* PFR., Monogr. ii, p. 282.—*Glandina paragramma* MORELET, Testac. Noviss. i, (1849), p. 15, (Cabanas, Cuba).

11. O. ORYSACEA (Orbigny). Pl. 33, figs. 1, 2.

The figures represent the example from La Vigia, Trinidad, dissected by me, of which I have figured the anatomy on plate 35. It measures, length 17.8, diam. 6, length of aperture 9 mm. The spire is wide and convex except near the apex, where it is somewhat attenuated. Whorls $7\frac{1}{3}$, convex, very glossy, yellow with a narrow gray border below the suture. The first four whorls increase slowly and regularly; the next whorl widens rapidly, the suture therefore descending more obliquely; after this the increase in width becomes very slow again. Orbigny's type measurements are length 19, diam. 6 mm. He also confused with *orysacea* a smaller form from Santiago, perhaps specifically different. His material was from several sources.

Central Cuba: Jagua (M. Lanier, type loc.); around Trinidad, common (Gundlach, Pilsbry); limestone rocks of San José, near Sancti Spiritus (Pilsbry); near Cienfuegos (Emilio F. Cabada).

Achatina orysacea ORB., Historia etc. de Cuba Moluscos, p. 88 (1845).—*Helix orysacea* RANG, Ms.—*Oleacina regularis* Gundlach, PFR. Malak. Bl. iv, 1857, p. 109 (Mountains near Trinidad); Monographia iv, p. 634.

The largest shell I found measures, length 21, diam. 6, aperture 9.7 mm. It is from the west side of La Vigia, Trinidad.

The other small Lævoleacinas of Cuba are as follows; for descriptions see Tryon, Vol. I, pp. 23-25.

1839. O. SUBULATA Pfr.

1841. O. OTTONIS Pfr. (plus *semistriata* Mor., 1849).

1846. O. LINDONI Pfr.

1849. O. SICILIS Morelet, O. ONYCHINA Morelet, O. FOLLICULARIS Morelet, O. INCERTA Reeve.

1857. O. SATURATA Gundl.

1860. O. TRANSLUCIDA Gundl.

1866. O. POEYANA Pfr., O. WRIGHTI Pfr., O. TERES Pfr.

1867. O. INCISA Pfr.

Genus RECTOLEACINA Pilsbry, n. gen.

Streptostyla, Cuban species, of authors.

Shell oleacinoid, oblong-fusiform, with a rather long spire, covered with a glossy yellowish cuticle, marked with some ill-defined varix-grooves, elsewhere smoothish or vertically grooved; 2 to 2½ embryonic whorls smooth. Columella vertical, convex in the middle, spirally twisted, the edge thickened; outer lip arching forward in the middle. Type *R. cubensis* Orb.

Distribution, western Cuba.

I believe this group to be parallel to *Streptostyla* but not directly related to that genus. It is, in my opinion, a derivative from *Lævoleacina*, from which it differs by the weakening of the columellar truncation, which is converted into a curve. Much careful work remains to be done before the relationships of *Lævaricella*, *Lævoleacina* and *Rectoleacina* to each other and to *Varicella*, *Oleacina* and *Streptostyla* can be understood. The problem demands a comparative study of the soft anatomy.

a. Surface nearly smooth.

b. Shell longitudinally streaked with brown, 25 to 30 mm. long. *R. cubensis*.

b¹. Shell uniform except for a subsutural brown band, 10 to 11 mm. long. *R. suturalis*.

a¹. Spire closely costulate; length 20 to 25 mm.

R. episcopalis.

1. *R. CUBENSIS* (Orbigny). Pl. 33, fig. 13.

The fusiform-oblong shell is yellow with a greenish tint, with irregularly-spaced, sinuous, longitudinal chestnut stripes and streaks. The surface is glossy, marked with faint growth-lines and a few impressed varix-grooves. Whorls 7½, slightly convex, slowly and regularly widening.

Length 30.5, diam. 10.7, aperture 17 mm. (Viñales).

Length 28, diam. 11.6, aperture 17.7 mm. (Sagua).

Length 25, diam. 9, aperture 15 mm., whorls $6\frac{3}{4}$.

Western Cuba: Rangel, Guane, Pan de Azucar, Sumidero (Arango), Viñales, Sagua (Wright).

Achatina cubensis ORB., in de la Sagra's Historia fisica, politica y natural de la isla de Cuba, v, Moluscos, 1845, p. 87, pl. 10, f. 17-19.—*Streptostyla cubensis* ARANGO, Fauna Malacologica Cubana, p. 97.—*Achatina cubaniana* ORB., in Sagra's Histoire physique, polit. et nat. de l'île de Cuba, Mollusques, i, p. 166 (1853). — PFR., Monogr., ii, p. 282. — *Spiraxis cubaniana* PFR., Monogr., vi, p. 195. — *Streptostyla cubaniana* TRYON, Man. of Conch., i, p. 49. — CROSSE, Journ. de Conchyl., 1890, p. 179.

Orbigny changed the name of this species in the French edition of the "Mollusks of Cuba," which is the one ordinarily used, and hence an erroneous form has become current. The exact locality of the type was unknown.

2. *R. SUTURALIS* (Pfeiffer). Pl. 33, fig. 12.

The shell is small, thin, greenish-corneous, with a reddish-brown band bordering the suture below. The first two whorls are smooth and glossy, the rest with inconspicuous sculpture of fine growth-ripples and some fine, spaced, vertical grooves. Length 11, diam. 4.7, aperture 6 mm.

Cuba: near Matanzas, at the plantation El Fundador, on the Canimar river (Pfr., type loc.); Cardenas; Organ mountains (Arango).

Polypheumus suturalis PFR., Archiv f. Naturg. 1839, p. 353. — *Achatina suturalis* PFR., Monogr., ii, p. 284; Conchyl. Cab., pl. 18, f. 22, 23. — *Glandina s.*, Pfr., in PHILIPPI, Abbild. u. Beschreib. n. Conch., i, p. 132, pl. 1, f. 7.

3. *R. EPISCOPALIS* (Morelet). P. 33, figs. 14, 15, 16.

Shell cylindric-fusiform, pale yellow-green. Nearly two initial whorls are smooth; then *fine, regular, rounded vertical folds*, wider than their interstices, appear. On the penultimate, or sometimes the next earlier whorl, these folds are weak or obsolete on the lower part of the whorl, and on the

last whorl they are wholly wanting or persist weakly just below the suture, the surface being weakly striatulate and marked with a few growth-arrest grooves.

Length 24.8, diam. 8, aperture 13 mm.; whorls 9.

Length 21, diam. 7.2, aperture 12 mm.; whorls $8\frac{1}{2}$.

Length 23, diam. 8 mm. (Morelet).

Western Cuba: Rangel, and the whole Organ Mountains (Arango).

Glandina episcopalis MOREL., Testacea Novissima, i, p. 13 (1849). — *Streptostyla e.*, ARANGO, Fauna Malac. Cubana, p. 98.

Genus STREPTOSTYLA Shuttleworth.

Streptostyla SHUTTL., Mittheil. nat. Ges. Bern, 1852, p. 203. — v. MARTS. in Albers, Die Hel., 1860, p. 33, type *S. nicoleti*; Biologia Centrali Americana, Moll., p. 83. — STREBEL, Beitrag, etc., iii, pp. 5, 11, 1878.

Shell oblong, varying from cylindric to biconic, with piri-form or lanceolate, usually long and narrow aperture; outer lip arching forward in the middle. Columella strongly twisted spirally, bearing an entering callous lamella, passing in a broad curve into the basal lip. Animal externally as in *Euglandina*. Radula oleacinoid.

Type *S. nicoleti* Shuttl. Distribution, Mexico and Central America (one species in Venezuela?).

Streptostyla is akin to *Oleacina* in the general appearance and texture of the shell, rather than to *Euglandina*. The usually strong twist of the axis, with a callous cord superposed on its free edge, and the nearly complete obliteration of the basal truncation chiefly distinguish it. At the end of the callus a weak trace of the columellar truncation is generally visible. *Spiraxis* has undergone a similar modification of the columellar axis, and some forms of *Varicella* approach the same structure. In a few species, such as *S. lattarei*, there are some very weak varix-lines, preceded by dark streaks, as in certain forms of *Euglandina* and *Spiraxis*, but much less developed than is the rule in *Varicella*.

By the deposit of shell material internally in the crevice

where one whorl joins another, visible by transparence through the whorl from the outside, a subsutural band is formed. This varies in width in the different species, and is often a valuable distinctive character. Many of the species are very similar and their identification is often a matter of extreme difficulty. Of all authors who have discussed them, Strebel's work is the most thorough in description and illustration. The following account is supplemental to that in Vol. I.

Streptostyla flucki Bartsch, Nautilus, xx, p. 4, from near Wani, Nicaragua, has not been described.

Subgenus STREPTOSTYLA *s. str.*

The shell is large, oblong and striate, with costulate embryonic whorls, only the first half whorl or less being nearly smooth. Aperture long and narrow, the columella twisted in a strong, calloused spiral fold. Type *S. nicoleti*.

1. *S. NICOLETI* (Shuttleworth). Vol. I, p. 43.

Subgenus CHERSOMITRA *v.* Martens.

Chersomitra MARTS., in Albers, Die Heliceen, 1860, p. 33, type *S. nigricans*.

The shell is smooth or finely striate above, with a varnish-like gloss, the embryonic whorls smooth, apex rounded. The aperture is long and narrow, piriform or lanceolate; columella with a more or less convex and calloused spiral fold. Type *S. nigricans*.

2. *S. NIGRICANS* (Pfr.). Vol. I, p. 45.
3. *S. MITRÆFORMIS* (Shuttlew.). Vol. I, p. 45.
4. *S. LATTREI* (Pfr.). Vol. I, p. 44 (as *S. delattrei* Pfr. *Glandina oliva* Morelet, Testac. Noviss., i, p. 13, is a synonym).
- 4a. *S. LATTREI* var. *EDWARDSIANA* C. & F. Vol. I, p. 45.
- 4b. *S. LATTREI* var. *SALLEI* C. & F. Vol. I, p. 44. (Var. "*sallæi*" Martens.)
5. *S. IRRIGUA* (Shuttl.). Vol. I, p. 46.

- 5a. *S. IRRIGUA* var. *CINGULATA* C. & F. Vol. I, p. 45.
5b. *S. IRRIGUA* var. *VENTRICOSA* Martens. Biologia, p. 93.
5c. *S. IRRIGUA* var. *SIMILIS* Strebel. Vol. I, p. 45.
5d. *S. IRRIGUA* var. *QUIROZI* Strebel. Vol. I, p. 44. (*Spiraxis bullacea* Pfr., Malak. Bl., xiii, 1866, p. 84, is a very young state of this species, according to von Martens, Biologia, p. 93, pl. 5, f. 11.)
6. *S. SHUTTLEWORTHII* (Pfr.). Vol. I, p. 44.
7. *S. POTOSIANA* Dall. Pl. 29, fig. 67.

"Shell moderately large and solid, opaque white with a brilliantly polished translucent yellowish-olive periostracum, with occasional darker zones axially arranged; the periostracum after the death of the animal rapidly peels off, leaving the surface white and smooth; whorls in the adult seven, smooth, not wrinkled axially in front of the very distinct suture; spire rather blunt, the whorls between the sutures convex; sides of the last whorl somewhat parallel, apex and base of the shell about equally tapering; outer lip sharp, slightly sinuous; the aperture narrow behind and rather wide in front, the axis and pillar twisted as usual in the genus. Length of shell 40, of aperture 28, of last whorl 34 mm.; max. diameter 15.5 mm." (Dall).

Mexico: Alvarez Mountains, State of San Luis Potosi, at a height of 7,200 ft. (Dr. E. Palmer).

S. potosiana DALL, Smithsonian Misc. Coll., vol. 48, p. 190, pl. 44, f. 4 (July 1, 1905).

This species is related to *S. shuttleworthi* and *S. novoleonis*. The columellar fold is less developed than in the former, and the latter part of the second whorl and first half of the third are much narrower. It is about twice the size of *S. novoleonis*, differing further by the less impressed suture, the whorl sloping up to the suture, not flattened below it as in *novoleonis*.

8. *S. PALMERI* (Dall). Pl. 29, fig. 68.

"Shell small, slender, subtranslucent, with a pale, thin,

straw-colored periostracum axially zonate with lighter and darker streaks following the lines of growth; whorls six, the last much the largest, spire rather blunt, the suture evident but not deep, appressed, and without axial wrinkles in front of it; pillar white, slightly thickened and twisted about a pervious axis; length of shell 24.5, of aperture 20, of last whorl 22.25 mm., max. diameter 9.5 mm." (Dall).

Mexico: Alvarez Mountains, State of San Luis Potosi (Dr. E. Palmer).

Streptostyla palmeri DALL, Smithsonian Miscellaneous Collections, vol. 48, pt. 2, p. 191 (July 1, 1905).

"This approaches *S. sallei* Crosse & Fischer, but is more slender, has a shorter spire, and is of a lighter make and color. From *S. potosiana*, of the same size, it is distinguished by its more slender build, more produced spire, and pervious axis, as well as by the difference in color. It has a shorter spire than, and different color from *S. shuttleworthi* Pfeiffer" (Dall).

Figured from one of the type lot, supplied by Dr. Dall.

9. *S. NOVOLEONIS* Pilsbry. Pl. 29, figs. 69, 70.

Shell cylindric-oblong, blunt at the ends, dark reddish-brown, very glossy, almost smooth, the growth-wrinkles being inconspicuous. Spire short, conic, the apex obtuse. Whorls $6\frac{1}{2}$, slowly and irregularly increasing; the first whorl widens rapidly; the latter part of the second whorl and first part of the third are very narrow; following whorls regular. The last whorl widens more rapidly, the suture in its later half or three-fourths rapidly descending, the last whorl being more or less deflexed at its termination. Aperture very long and narrow, its lower third somewhat dilated. Outer lip but very slightly arched forward, scarcely retracted above. Basal margin somewhat retracted; columella short, rather thin, but little twisted.

Alt. 17.5, diam. 7.3, length of aperture 12.3 mm.

Alt. 16, diam. 7, length of aperture 12.6 mm.

N.-E. Mexico: Diente, near Monterey, State of Nuevo Leon.

S. novoleonis PILS., Proc. A. N. S. Phila. 1899, p. 397; 1903, p. 774, pl. 48, f. 3, 3a.

Much smaller than *S. shuttleworthi* and the varieties subordinated thereto by Dr. von Martens, short in the spire, markedly cylindrical, with the columella only weakly twisted. The region around Monterey is very different in physical characteristics from that inhabited by *S. shuttleworthi*. It is considerably further north than *Streptostyla* has heretofore been found.

10. *S. CYLINDRACEA* (Pfr.) Vol. I, p. 48.

11. *S. STREPTOSTYLA* (Pfr.). Vol. I, p. 47, as *S. pfeifferi* C. & F.

11a. *S. STREPTOSTYLA* var. *CONIFORMIS* (Shuttl.). Vol. I, p. 47 (includes *S. blandiana* C. & F., I, p. 47).

12. *S. CONULUS* v. Martens. Pl. 28, fig. 60.

Shell narrowly coniform, solid, very lightly striatulate, yellow, glossy. Spire moderate, obesely conic, the apex rather obtuse. Whorls 7, a little convex, the penult. whorl double the height of the preceding, the last whorl narrowing downwards, not deflexed at the aperture. Suture simple, marked with a pale gray band, but no groove. Aperture narrowly linear, a little dilated below; outer lip slightly arching forward below the middle; columella thick, strongly twisted, open. Length 14, diam. 5, aperture 9.5 mm. long, .66 mm. wide above, 1.5 below (*Marts.*).

Western Mexico: Sayula, State of Jalisco (Höge).

Streptostyla conulus MARTS., Biologia Centrali Amer. Moll., p. 94, pl. 5, f. 15.

"Only one specimen. Resembles in many points *S. coniformis*, but is much smaller and yet very thick, so that it cannot be young. It is also considerably more slender, with proportionately longer spire" (*Marts.*).

13. *S. GRACILIS* Pilsbry, n. sp. Pl. 28, fig. 66.

Shell very narrow and slender, glossy, of a rather bright yellow color, weakly wrinkle-striate, biconic, widest at the upper third of the length. Spire conic, the apex obtuse. Whorls 6, but slightly convex, regularly increasing, the last

not deflexed. Suture but slightly impressed, with a grayish border but no groove. The last whorl tapers to the base, the outlines slightly convex. The aperture is very narrow, but slightly wider near the base. Outer lip slightly arched forward below, retracted at the base. The columella bears a very high, white lamella, obscurely bifid or doubled at the base. This lamella continues strong within, and is faintly visible through the last whorl. The whorl is deeply excavated just above the lamella. Length 11, diam. 4.3, length of aperture 8.3 mm.

Northeastern Mexico: Valles, State of San Luis Potosi (A. A. Hinkley).

This species is closely related to *S. conulus* Marts., but so far as the description and figure of that species show, it has not the peculiar sulcus above the columellar lamella which is so prominent in *S. gracilis*. The latter also tapers more toward the base.

14. *S. OBESA* v. Martens. Pl. 29, fig. 71, 72.

Shell oblong-ovate, lightly striatulate, glossy, orange-yellow, unicolored. Suture submarginate, narrowly white. Spire conic, rather acute. Whorls $8\frac{1}{2}$, regularly increasing, slightly convex. Aperture more than half the length of the shell, obliquely lanceolate; the outer margin arching forward below; columella subvertical, lightly twisted. Length 38, diam. 18, aperture 18x9 mm. (*Marts.*).

Honduras (Berlin Museum, one specimen).

S. obesa MARTS., *Biologia*, p. 95, pl. 5, f. 12, 12a (May, 1891).

"Nearly allied to *S. turgidula* Pfr., but distinctly broader, the diameter equal to the length of the aperture; coloration more orange, and without darker varices. The suture also in the last whorl is regular, not indented by stoppages of growth, and the white color of the suture itself is more conspicuous" (*Marts.*).

15. *S. TURGIDULA* (Pfr.). Vol. I, p. 46.

- 15a. *S. TURGIDULA* var. *GUATEMALENSIS* C. & F. (According to von Martens, this includes *S. schneideri* Strebel, Vol. I, p. 48.)

16. *S. LABIDA* (Morelet). Pl. 29, fig. 73.

Shell ovate-conic, rather solid, very minutely striatulate, semidiaphanous, corneous-yellow, striped on the last whorl with some pale greenish streaks. Spire conic, short; suture slightly impressed, margined. Whorls 7, a little convex, the last more than half the length of the shell. Columella callous, twisted, scarcely truncate. Aperture narrow, semioval. Length 22, diam. 10.5 mm. (*Morelet*).

Guatemala: Vera Paz (*Morelet*).

Glandina labida MORELET, Testac. Noviss., ii, p. 13 (1851). —*Streptostyla labida* Morel., MARTENS, Biologia, p. 96, pl. 5, f. 16.

"Very near the preceding, but comparatively somewhat shorter and marked with a distinctly impressed line below the suture. Figured from a typical specimen sent to me by M. A. Morelet" (*Martens*).

17. *S. LURIDA* (Shuttl.). Vol. I, p. 45 (includes *S. bocourti* C. & F., vol. I, p. 46).

S. lurida is well distinguished by its deep, channelled suture. A specimen referable to var. *major* C. & F. before me is pale greenish-yellow instead of brown or fulvous, and measures, length 21, diam. 10, length of aperture 14.7 mm.

18. *S. NEBULOSA* Dall. Pl. 29, fig. 74.

"Shell of a brilliant yellow brown, clouded irregularly with opaque blotches, thin, ovoid, with $5\frac{1}{2}$ whorls; nucleus smooth, the apex blunt, the second whorl wider between the sutures than the third; surface of the shell polished, with the incremental lines occasionally and irregularly conspicuous; spire short, the suture deep and channeled, but narrow; base slightly attenuated, pillar with its edge thickened, twisted, and slightly reflected; outer lip thin, sharp, nearly straight. Length 22, maximum diameter 10 mm." (*Dall*).

Mexico: San Cristobal, Chiapas, found inside of a large Helix (E. W. Nelson, no. 107369 U. S. N. M.).

Streptostyla nebulosa DALL, Proc. U. S. Nat. Museum, xix, p. 364 (1896).

"This species is nearest to *S. bocourti* Crosse and Fischer, but has a more oval form, less pointed and less elevated spire" (Dall).

19. *S. SUMICHRASTI* Ancy.

Shell cylindric-oblong, thin, very glossy, obsoletely, flexuously substriatulate, bright fulvous-corneous, uniform or with the obtuse apex paler. Spire gradate, conoidally tapering. Whorls $6\frac{1}{2}$, a little convex, separated by a channelled suture, the last whorl elongate, slightly flattened on the right side. Aperture subauriform, long and tapering above, somewhat dilated basally; columellar lamina thin, scarcely caloused, long, spirally twisted, slightly truncate in front at the base; peristome slightly obtuse, flexuous, dilated forward in the middle, receding at base. Length 29, diam. 13, alt. aperture 19.5 mm. (Ancy).

Isthmus of Tehautepec (coll. Ancy, Dautzenberg, Jousseaume).

S. sumichrasti ANC., Nautilus, xvii, p. 56 (Sept. 1903).

"Related to the smaller *S. lurida* and *S. bocourti*, but much more slender than the latter and of a more graceful oblong shape than the former" (Anc.).

20. *S. CHIRIQUIANA* v. Martens. Pl. 29, fig. 75.

Shell ovate-conic, rather thin, yellowish. Whorls 7, subplano-convex, at the suture margined, glabrous, glossy. Columella short, arcuate and twisted. Aperture oblong, half the total length. Length 22, diam. 11, aperture 11×4.5 mm. (Da C.).

Panama: Chiriqui.

Streptostylus flavescens DA C., Proc. Malac. Soc. Lond., iv, p. 66, pl. 7, f. 1 (August 1, 1900), not of Shuttl. 1852.—*Streptostylus pallidus* DA COSTA, t. c., p. 185 (March 19, 1901).—*Streptostyla chiriquiana* MARTENS, Biologia Centrali Amer., Moll., p. 615 (January, 1901).

This very briefly described form differs from *S. viridula* Angas by its slightly more lengthened contour and comparatively shorter aperture.

21. *S. DELIBUTA* (Morelet). Pl. 29, fig. 77, 78, 80.

Shell cylindrical, thin, very minutely striate, glossy, semi-diaphanous, corneous-green. Spire conoidal, short, the apex rather obtuse; suture slightly impressed, margined. Whorls 7, flattened, the last longer than the spire. Columella callous, twisted, outwardly subtruncate. Aperture narrow, dilated basally, pearly within. Peristome simple, the outer margin dilated in the middle. Length 23, diam. 10 mm. (*Morel.*).

Guatemala: Vera Paz (Morelet); environs of Yzabal (Stoll); Alta Vera Paz (v. Ihering).

Glandina delibuta MOREL., Testac. Noviss., ii, p. 13 (1851). —*Streptostyla d.*, MARTENS, Biologia, p. 97, pl. 5, f. 18, 18a.

"The suture becomes *very obliquely descending and distinctly margined (accompanied by an impressed line)* in the last whorl, but much less so in the preceding ones. The spire is a little concavely attenuated at about the third whorl, though on the whole rather broad and obtuse at the apex" (*Martens*).

The type figures are copied from von Martens, figs. 77, 78. Under a strong lens faint, fine spiral lines are visible, as shown in the detail figure. This is a rare feature in *Streptostyla*; however, on some specimens it is very difficult to make them out, and only in a few places. The outer lip is rather strongly arched forward, as shown in fig. 80, which represents the slenderest of several specimens before me. The columellar callus in some shells forms a decidedly more projecting fold than in Morelet's type. The shell is quite solid, with a very thin pale yellowish-green cuticle, the interior fleshy-white. Specimens measure: 23.7x10.25, apert. 15 mm.; 22x9.3, apert. 14 mm.; 23.7x10.7, apert. 15.3 mm.

22. *S. CRASSA* Strebel. Vol. I, p. 47.

Distinct from *delibuta* by its wider contour.

23. *S. VENTRICOSULA* (Morelet). Pl. 30, figs. 87, 89.

"Shell ovate, glossy, pellucid-fulvous. Whorls 5, nearly flat, the last rather ventricose; spire rather obtuse, short. Columella calloused, spiral, white, prominent, arcuately confluent with the basal margin, the truncation evanescent. Aperture narrow, irregularly oblong, rounded basally more than half the shell's length. Length 13, diam. 6, length of aperture 8 mm." (*Morelet*).

Yucatan: Merida (*Morelet*); Merida, Ticul, Tabi and Uxmal (*Heilprin* expd.).

Glandina ventricosula MOREL., Testac. Noviss., i, p. 15 (1849).—*Streptostyla v.*, MARTS., Biologia, p. 97, pl. 5, f. 20.

As Prof. von Martens has pointed out, this species differs from *S. cylindracea* Pfr., with which it has been united. Fig. 87 is a copy of v. Martens' figure of the type specimen. A series from the type locality and other places southward was taken by the expedition sent out by the Academy in 1890. An example from Uxmal is drawn in fig. 89. The first whorl increases very rapidly, and at its termination is wider than the adjacent part of the following whorl. The last whorl widens much more rapidly than those preceding, the descent of the suture being accelerated. The suture is very slightly impressed and has a rather wide, clear margin below. The sides of the last whorl are decidedly convex. The aperture is lanceolate, the outer lip being rather strongly arched forward in the middle. The columella is rather strongly twisted, and bears a callous flange on its face. The shell figured measures, length 12, diam. 5.8, aperture 8 mm., whorls $5\frac{1}{3}$.

24. *S. YUCATANENSIS* Pilsbry, n. sp. Pl. 30, figs. 90, 91.

Shell oblong, thin, amber-yellowish, subpellucid, very glossy, with weak growth-lines. Whorls $5\frac{1}{3}$, the first one slightly wider at its termination than the whorl below it, the rest regularly increasing to the last, which in its later half descends more rapidly. The suture is narrowly but rather deeply impressed, and has only an extremely narrow linear border. The last whorl is somewhat cylindric. The aperture has the usual lanceolate shape. Outer lip strongly arched

forward in the middle, retracted above and below. Columella only moderately twisted, its face being a thin flange, narrow in front view but wide as seen in profile. Length 13.2, diam. 6, aperture 9 mm. Another specimen measures, length 14.3, diam. 6.1, aperture 9.1 mm.

Yucatan: Tekanto (type loc.) and Ticul (Heilprin exped.).

This species is closely related to *S. ventricosula*, but differs by its deeper suture and consequently much narrower sub-sutural clear border, by the less swollen first whorl, more cylindric last whorl, and the weaker columellar fold. It has not the rapidly descending last whorl of *S. sololensis*, and the columellar fold is not so strong as in *S. meridana cobanensis*. It occurs with *S. ventricosula* and *S. meridana*.

24a. Var. *distorta*, n. v. Pl. 30, fig. 92.

A single specimen from Tekanto differs from the rest of the series from that place in having the last half of the second and first half of the third whorl very narrow, less than half the width of the adjacent whorls above or below; otherwise like *S. yucatanensis*. Without a large series it is impossible to say whether this is merely an individual variation or indicates a separate species or race. Length 13.5, diam. 6, aperture 9 mm.

25. *S. MERIDANA* (Morelet). Pl. 30, figs. 93, 94, 95, 96.

"Shell ovate-oblong, somewhat solid, glossy, pellucid, tawny. Whorls 6, flattened, with a submarginate suture. Columella callous, spirally projecting, white, arcuately curved, the truncation evanescent. Aperture narrow, irregularly oblong, rounded basally more than half the length of the shell. Length 12, diam. 4.5 mm." (*Morelet*).

Yucatan: Merida (*Morelet*); Santa Ana near Calcehtok; Tekanto; Ticul; hacienda of Tabi, and from between Sitalpech and Tunkas (*Heilprin exped.*).

Glandina meridana MOREL., Testac. Noviss., i, p. 15 (1849).—*Streptostyla m.*, MARTENS, Biologia, p. 101, pl. 5, f. 25.—*Spiraxis cobanensis* TRISTRAM, P. Z. S. 1861, p. 231. Cf. MARTENS, l. c., fig. 26.—*Streptostyla cornea* C. & F., Journ.

de Conchyl. 1869, p. 33; Miss. Sci. Mex., Moll., i, p. 51, pl. 1, f. 13, 13a.

"Near the preceding [*S. sololensis*], but of smaller size, thinner, the suture not white, but of the same yellow color as the rest of the shell. Owing to the kindness of M. A. Morelet, I have been enabled to compare directly his original specimens of *S. meridana* (fig. 96) with the type of *S. cobanensis* Tristr. (fig. 97), and with the figure of Fischer and Crosse's *S. cornea*; Morelet's type is only a little smaller, comparatively more slender, and paler in color, without any marked difference. The statement 'length 18 mm.' is a misprint for 13 mm., as shown by the specimens themselves" (*Martens*).

The type of *S. meridana* has been figured by von Martens, and copied on my plate, fig. 96. I give some additional figures, on a larger scale, of specimens in the collection made by the Academy expedition:

Fig. 93, Santa Ana, near Calcehtok, 11x4.5, aperture 7 mm.

Fig. 94, Tekanto, 10x4, apert. 6.8 mm. Last whorl very slowly descending; columellar fold weak, spire short.

Fig. 95, Ticul, 10.25x4, apert. 6 mm. Last whorl more descending, the spire longer, columellar fold strong.

In all the lots there is a quite narrow, clear, subsutural margin, and the outer lip arches strongly forward in the middle. Variation in size and contour is considerable. It is more slender than the allied species *S. ventricosula* and *S. yucatanensis*, which occur with it in northern Yucatan.

25a. Var. *cobanensis* (Tristram). Pl. 30, fig. 97.

Larger, length 13 to 14, diam. 5.3 to 5, alt. aperture 7 to 8 mm., and a little wider (*Marts.*) Guatemala.

26. *S. SOLOLENSIS* C. & F. Vol. I, p. 46.

27. *S. COSTARICENSIS* Da Costa. Pl. 29, fig. 82.

Shell cylindric-oblong, thin, pellucid-corneous, spire short, obtuse at the apex. Whorls $5\frac{1}{2}$, almost flattened-convex, margined at the suture, smooth, polished. Columella short and twisted. Aperture oblong, narrowly auriform, the outer lip impressed in the middle, white at the edge. Length 19, diam. 9, aperture 13x3.5 mm. (*Da Costa*).

Costa Rica: Azajar de Cartago (Underwood).

S. costaricensis DA C., Proc. Malac. Soc. Lond., vi, p. 6, pl. 1, f. 3 (March, 1904).

"It much resembles *S. cylindracea* Pfr., but is more ovate and has a shorter aperture." Should be compared with *S. binneyana* C. & F.

28. *S. BINNEYANA* C. & F. Vol. I, p. 47. Pl. 30, fig. 98.

Includes var. *major* Martens, according to that author. Von Martens' figure is copied, pl. 30, fig. 98. In my opinion this form cannot be united with *S. ventricosula*.

29. *S. THOMSONI* Ancey.

Shell subfusiform, rather thin, subpellucid, very glossy, with an oily luster; amber-buff, ornamented with darker, somewhat irregularly-placed streaks on the last whorl. Spire long-conic, the apex minute, hardly obtuse. Whorls $8\frac{1}{2}$ (?), subplanulate, regularly and slowly increasing, separated by a narrow suture with slightly paler margin, obsoletely, closely and minutely plicatulate in front of the suture, smooth; last whorl large, cylindric at the sides, somewhat tapering basally, a little convex above. Aperture vertical, pallid within, narrow, sinuate-semioval. Columellar lamina white, twisted, rather solid, thickened in the middle. Peristome simple, rather obtuse, receding at base, sinuously produced in the middle. Length 30, diam. 12, aperture 14×4.33 mm. (Ancey).

Length 16.5, diam. 9.33, aperture 12.33×3.66 mm.; young shell.

Length 12, diam. 5.66, aperture 8×2 mm.; young shell.

Utila Island, off Honduras (Simpson).

S. thomsoni ANC., Annales de Malacologie 1886, p. 257.

There is great variation in shape, especially among shells of different ages, the last whorl being strongly conic in young ones.

30. *S. VIRIDULA* Angas. Pl. 29, fig. 81.

The shell is very obesely fusiform, the diameter exceeding

half the length, moderately solid though thin, pale greenish yellow or yellowish green, glossy. About $2\frac{3}{4}$ apical whorls are smooth, then fine irregular striae begin, and the sutural margin becomes distinct. On the last two whorls this border is pale, nearly smooth, and limited by an impressed line; the striation below it being sharp and strong, but rapidly fading out downwards, very weak on the middle and base. The aperture is vertical, fleshy-whitish inside. The outer lip arches forward a little in the middle. The columella is very strongly twisted, a strong lobe projecting into the aperture, and moderately calloused at the edge. Length 17, diam. 9.5, aperture 11 mm.; whorls $6\frac{1}{2}$.

Costa Rica: Hills of Uren (Gabb), type in coll. A. N. S. P.

S. viridula ANGAS, P. Z. S. 1879, p. 482, pl. 50, f. 12.—MARTENS, Biologia, pp. 98, 616 (numerous Costa Rican localities).

A remarkably obese species, one of the widest known to me, and further distinguished by its distinctly striate upper surface and greenish-yellow color. As the original account is rather unsatisfactory I have redescribed and figured the type specimen.

31. *S. PLICATULA* Strebel. Vol. I, p. 47.

32. *S. BICONICA* (Pfeiffer). Pl. 29, fig. 79.

Shell subfusiform, conically tapering both above and below, rather solid, smooth, glossy, pale reddish-corneous. Spire conic, rather acute; suture margined. Whorls 7, slightly convex, the last slightly longer than the spire, markedly tapering to the base. Columellar lamina callous, twisted, not truncate. Aperture subvertical, extremely narrow, acuminate oblong; peristome simple, the right margin strongly arched forward. Length 13.5, diam. 6, aperture 8×1.66 mm. (*Pfr.*).

Southern Mexico: Chiapas (Ghiesbreght, in Cuming coll.).

Spiraxis biconica PFR., P. Z. S. 1856, p. 378; Malak. Bl., iii, p. 233 (1856); Monogr., iv, 578.—*Streptostyla b.* PFR., MARTENS, Biologia, p. 98, pl. 5, f. 17, 17a.

Figured by von Martens from a specimen in the collection

of the late Mr. Albers, who had it probably from Pfeiffer himself.

33. *S. GABBI* Pilsbry, n. sp. Pl. 30, figs. 2, 3.

The shell is very thin, oblong, orange-brownish, slightly paler on the spire, glossy and smooth except for very weak growth-wrinkles. Whorls nearly $5\frac{1}{2}$, the first very small at the tip, then suddenly enlarging, the rest slightly convex, regularly increasing, the latter half of the last whorl descending more rapidly. Suture lightly impressed, delicately edged with a white line, which fades below into a very narrow dark border. The last whorl has evenly convex sides. Aperture lanceolate, the outer lip only very slightly arched forward. Columellar fold thin and sharp, moderately twisted. Length 22, diam. 10 mm., length of aperture 15.8 mm.

Costa Rica: on the ridge between Tilorio and Zorquin (Gabb).

Streptostyla boucardi Pfr. var. (?) ANGAS, P. Z. S. 1879, p. 482.—*S. boucardi* TRYON, Manual, vol. i, pl. 10, f. 72.

This species is related to *S. shuttleworthi*, but it is shorter and broader, the last whorl being more inflated; the color is darker and uniform. Angas thought to unite it as a variety to *S. boucardi* Pfr., but that form, though smaller, has six whorls, and the aperture is decidedly shorter.

Gabb describes the living animal as "light brown above, whitish below and posteriorly; tentacles dark brown; carries the tip of the tail slightly turned up in travelling." His original sketch in color is reproduced in fig. 2.

34. *S. FLAVESCENS* (Shuttl.). Vol. I, p. 48.

34a. *S. FLAVESCENS* var. *boucardi* (Pfr.). Pl. 29, fig. 83.

The figure is a copy from von Martens of a sketch of the type drawn by Mr. Edgar A. Smith. Tryon's figure in vol. I does not represent *boucardi*, but a different species collected by Gabb in Costa Rica.

35. *S. FULVIDA* C. & F. Vol. I, p. 46.

36. *S. GLANDIFORMIS* C. & F. Vol. I, p. 46.

37. *S. PHYSODES* (Shuttl.). Vol. I, p. 49 (includes *Spiraxis auriculacea* Pfr., vol. I, p. 49).

38. *S. LIMNEIFORMIS* (Shuttl.). Vol. I, p. 49 (*S. limnaeiformis* Martens).

38a. *S. LIMNEIFORMIS* var. *PARVULA* (Pfr.). Pl. 30, fig. 88.

Spiraxis parvula PFR., P. Z. S. 1856, p. 379; Monogr., iv, p. 579.—*Streptostyla p.*, MARTENS, Biologia, p. 100, pl. 5, f. 24. Chiapas (Ghiesbreght).

39. *S. OBLONGA* (Pfr.).

Shell oblong, rather solid, smooth, glossy, flesh-colored. Spire long-conic, the apex obtuse; suture slight, broadly margined. Whorls 5, flat, the last slightly longer than the spire, a little tapering basally. Columellar lamina compressed, with a high twist [*"alte torta"*] at base, not truncated. Aperture vertical, narrowly oval, long-acuminate; peristome simple, the right margin lightly arching forward. Length 9.66, diam. 4.5, aperture 5 x 1.5 mm. (Pfr.).

Chiapas (Ghiesbreght, in Cuming coll.).

Spiraxis oblonga PFR., P. Z. S. 1856, p. 378; Monogr., iv, p. 579.

Known only by the above description.

40. *S. DYSONI* (Pfr.). Vol. I, p. 48.

41. *S. VEXANS* Strebel. Vol. I, p. 49.

42. *S. BOYERIANA* C. & F. Vol. I, p. 48.

43. *S. SARGI* C. & F. Vol. I, p. 49.

43a. *S. SARGI* var. *PALLIDIOR* C. & F. Pl. 29, fig. 84.

Pale-colored, with longitudinal whitish streaks. 16x6, aperture 7 mm. N. Guatemala at Coban (Sarg.).

43b. *S. SARGI* var. *CHAMPIONI* Martens. Pl. 29, fig. 85.

Comparatively a little more ventricose; golden-yellow with faint paler streaks. 15x6, apert. 7 mm. (Marts.). Sabo in Vera Paz, N. Guatemala (Champion).

44. *S. MOHRIANA* (Pfr.).

Shell subcylindric, thin, smooth, pellucid, corneous-hyaline; spire slowly tapering, the apex rather obtuse; suture light, distinctly margined. Whorls 6, a little flattened, the last subequal to the spire. Columella somewhat calloused, lightly twisted. Aperture narrow, oblong-acuminate; peristome simple, slightly obtuse. Length 7.5, diam. 2.5, aperture 3.5 mm. (Pfr.).

Eastern Mexico: Cerro de Borrego, near Orizaba (Mohr collection).

Spiraxis mohriana PFR., Malak. Bl., ix, p. 97 (1862); Monogr., vi, p. 196.

45. *S. CLAVATULA* Ancey.

Shell small, at first sight resembling a *Ferussacia* of the *F. procerula* group, thin, glossy, slightly striatulate obsoletely, apparently pale corneous when fresh, whitish-hyaline when dead, cylindric elongate, rather oblong. Spire produced, regularly tapering, obtuse, the apex large. Whorls $6\frac{1}{4}$, subplanulate, the suture appressed, not very distinct, with a pellucid margin below; last whorl cylindric-oblong, somewhat tapering at base. Aperture narrow above, dilated below; columellar lamina short, not very strong, subcalloused, lightly twisted spirally, the base slightly truncate. Peristome obtuse, arched forward in the middle, receding at the base. Length 8.66, diam. 3, alt. apert. 4 mm. (Ancey).

Central America (?).

S. clavatula ANC., Nautilus, xvii, p. 56 (Sept. 1903).

"A small elongate shell resembling a *Ferussacia*" (Anc.).

46. *S. SUBCALLOSA* (Pfeiffer).

Shell subfusiform-oblong, thin, smooth, glossy, pellucid, hyaline-buff. Spire conic, obtuse; suture distinctly margined. Whorls $5\frac{1}{2}$, a little convex, the last nearly two-thirds the total length, tapering basally. Columella somewhat calloused, slightly twisted, subtruncate at base. Aperture vertical, narrow, acuminate-oblong; peristome simple, the right margin arching forward. Length 14, diam. 6, aperture 9×2 mm. (Pfr.).

Venezuela (Cuming coll.).

Spiraxis subcallosa PFR., P. Z. S. 1855, p. 99; Monogr., iv, p. 577.

This species has not been figured. The locality needs confirmation, no other species of the genus being known to occur in South America.

Subgenus STREPTOSTYLELLA Pilsbry, n. s.-g.

Shell small, slender, with lengthened spire and small aperture, the first $1\frac{1}{2}$ whorls nearly smooth, the rest closely costulate, the later whorls angular above; columella Streptostyloid. Type *S. botteriana*.

47. *S. BOTTERIANA* C. & F. Vol. I, p. 44.

Subgenus PETENIELLA Pilsbry, n. n.

Petenia CROSSE et FISCHER, Diagnoses Molluscorum novorum Guatemalæ et Reipublicæ Mexicanæ, Journ. de Conchyl. 1869, p. 35 (p. 7 of separate copies issued Nov. 1, 1868), sole species *P. ligulata*; Miss. Scient. au Mex., Moll., i, p. 66. Not *Petenia* Günther, in Pisces, 1862.

The shell is like *Chersomitra* except in having a dark band at the periphery. According to Morelet, the tail is abruptly truncated at the end, and has a mucous pore. This structure needs further investigation, since a caudal pore elsewhere occurs only in Aulacopod pulmonates.

48. *S. LIGULATA* (Morelet). Vol. I, p. 50.

49. *S. CATENATA* (Pfr.). Vol. I, p. 251.

Subgenus VARICOTURRIS Pilsbry, n. s.-g.

The shell is small, oblong-turrite, with a long spire composed of narrow, convex whorls, the aperture short and diagonal; embryonic whorls apparently smooth, the rest vertically ribbed, with occasional dark streaks; columella excised at base, not much twisted. Type *S. dubia* Pfr.

50. *S. DUBIA* (Pfeiffer). Pl. 28, fig. 65.

Shell turrite-oblong, rather solid, provided with close,

strong, obtuse plicæ, somewhat glossy; corneous-whitish irregularly painted with chestnut streaks, vanishing in the middle of the last whorl, subvaricose. Spire long, the apex acute; whorls 9, a little convex, the last less than one-third the total length. Columellar lamina thin, twisted, subvertical at the base of the aperture, forming a squarish channel. Peristome simple, the margins joined by a thin callus, the right margin arching forward slightly, basal margin receding. Length 9.5, diam. nearly 5, aperture 3.5×1.5 mm. (*Pfr.*).

Chiapas (Ghiesbreght, in Cuming coll.).

Spiraxis dubia PFR., P. Z. S. 1856, p. 378; Malak. Bl. 1856, p. 232; Monogr., iv, 580.—*Streptostyla dubia* Pfr., MARTENS, Biologia, p. 90, pl. 5, f. 10.

Von Martens' figure, copied here, is from the type, the exact measurements of which are, length 9.33, diam. 4 mm.

Subgenus *PITTIERIA* v. Martens.

Pittieria v. MARTENS, Biologia Centrali Americana, Moll., p. 617 (January, 1901).

"In the scheme of coloration and the smooth shining surface it agrees with various species of *Streptostyla*, e. g. *S. nigricans* and *S. mitraformis*; but the columella is scarcely twisted and at the lower end distinctly truncate. From *Glandina* it differs in the very smooth shell, without granulation, and in the columella not being concavely bent" (*Martens*).

51. *S. BICOLOR* v. Martens. Pl. 29, fig. 86.

Shell turrit, rather solid, very lightly striatulate, glossy; rufous-brown with a wide sulphur-colored subsutural zone. Spire long-conic, the apex rather obtuse. Whorls $7\frac{1}{2}$, the first minute, papilliform, the second globose, both uniform brown, the following whorls regularly increasing, slightly convex, with the suture appressed, margins with a groove; the last whorl slowly tapering at the base, slightly convex, not deflexed in front. Aperture subvertical, elliptical, but angular above and below; peristome simple, obtuse, brown-margined within, the throat gray-bluish; outer margin slightly arcuate above, more so below; basal margin produced in a

rostrum; columellar margin slightly thickened and very lightly twisted spirally, truncate at the base. Length 21, diam. 10.33, aperture 10×5.5 mm. (Marts.).

Eastern Costa Rica: Uiskar, in Alta Talamanca (Pittier).

Streptostyla (Pittieria) *bicolor* MARTS., Biologia, Moll., p. 617, pl. 44, f. 6 (Jan. 1901).

Genus ORYZOSOMA Pilsbry.

Orizosoma PILS., Nautilus, v, p. 9 (May, 1891).—*Oryzosoma* PILS., Proc. A. N. S. Phila. 1891, p. 311 (Aug. 25, 1891).

Shell ovate-turrite, perforate, the columella concave, calloused on the face. Apical whorls smooth, the first $1\frac{1}{2}$ globose, the next whorl very narrow. Otherwise as in *Streptostyla*. Type *O. tabiense*.

This group was based upon a small shell resembling *Streptostyla* except in having the axis distinctly perforate and the columella not twisted spirally, though there is the almost imperceptible trace of a fold at its upper insertion.

1. *O. TABIENSE* (Pilsbry). Pl. 30, figs. 99, 1.

The shell is narrowly perforate, ovate-conic, thin but moderately solid, weakly striatulate, glossy. The spire is conic with obtuse apex. The first $1\frac{1}{2}$ whorls are rather large and very convex; the next $\frac{3}{4}$ whorl is extremely narrow; subsequent whorls increase slowly and are moderately convex. Suture moderately impressed. The last whorl is oval, convex at the base, and impressed around the umbilicus. The aperture is vertical, piriform, half the length of the shell. Outer lip arched forward in the middle, not retracted basally. The columella is concave below, straightened above, its edge rather heavily calloused. The upper end of the callus partially fills the mouth of the narrow umbilicus. Length 9.9, diam. 4.9, length of aperture 5 mm.; whorls 6.

Yucatan: Hacienda of Tabi, in a cave (Heilprin expd.).

Streptostyla (*Orizosoma*) *tabiensis* PILS., Nautilus, v, p. 9 (May, 1891); Proc. A. N. S. Phila. 1891, p. 311, pl. 15, f. 6, 7.

Only a single dead, white specimen was found, but it is, so far as I can see, an uninjured, normal shell, differing con-

spicuously from the several small common *Streptostylæ* of the same locality in proportions as well as by its perforate axis.

Genus POIRETIA Fischer.

Poiretia FISCHER, Manuel de Conchyliologie, p. 452, for *Glandina algira* (Feb. 21, 1883).—*Glandina*, *Achatina*, etc., auct.

For anatomy, see RAYMOND, Journ. de Conchyl., iv, 1853, pp. 14-29, pl. 1, f. 5.—CROSSE et FISCHER, Journ. de Conch., 1868, p. 234; Miss. Sci. Mex., Moll., p. 73, pl. 4, f. 10 (teeth of *G. algira*).—SIMROTH, Nachtschnecken der portugiesisch-azorischen Fauna, etc., Nova Acta Acad. Cæs. Leop.-Carol. Germ. Nat. Cur., vol. 56, 1891, p. 251, pl. 6, f. 16 (genitalia, muscles, etc., of *G. algira*).

The shell is oblong or fusiform, rather finely rib-striate, with the appearance and columella of *Euglandina*. Embryonic shell of about $2\frac{1}{2}$ whorls, the last $\frac{1}{2}$ to $1\frac{3}{4}$ of which are striate, the earlier whorl or half whorl smooth. The *lip processes are short and blunt*, about half as long as the lower tentacles, the exterior otherwise as in *Euglandina*.

Radula with about 20,1,20 teeth, the central small but well developed, having a distinct cusp; lateral teeth as in *Euglandina*.

Genitalia (pl. 25, fig. 5) with a short penis, terminating in a *transversely placed blind sack*. The long retractor is terminal, and is attached distally to the lung floor. The spermatheca is small, on a long duct, which enters high on the long vagina.

The retractor muscles have been figured by Simroth (pl. 25, fig. 10). The true columellar muscle is represented by a wide band acting as a tail retractor; laterally this gives off two long muscles which split distally, are inserted in the sole, and act as retractors of the foot in front. The right ocular and tentacular band crosses the penis, and seems to be joined proximally to the columellar muscle; the left unites near its base with the pharyngeal retractor.

The cerebral ganglia are pear-shaped, united by a short commissure; pedal ganglia concentrated.

Type, *P. algira* (Brug.). Distribution, Algeria, Sicily, Italy, Dalmatian coast, Greece; Tertiary of Europe.

Poiretia has a shell like *Euglandina*, but the development of a blind sack on the penis allies it rather to *Lævoleacina*. From both genera *Poiretia* differs by its short labial lobes which have been figured by Bourguignat (Malac. de l'Algerie).

The varying forms of *Poiretia* have been discussed at some length by von Martens (Malak. Blätter, vi, 1859, pp. 154-164), by Bourguignat (Malacologie de l'Algerie, ii, p. 117, 1864), and by Kobelt (Iconographie Europäischen Schaltragenden Conchylien, v, p. 55 (1877), and *neue Folge*, iii, 1888, p. 1.

The decision of von Martens and Kobelt that all recent forms of *Poiretia* are varieties of a single species seems to me to be open to appeal, for the reason that none of the authors who have written on the genus have taken into account the sculpture of the embryonic shell, but based their conclusions upon the general shape of the adult, and the shape of the columella.

1. *P. ALGIRA* (Bruguiere). Pl. 31, figs. 2, 4.

The type of *Bulimus algirus* was collected by the Abbe Poiret at Algiers. It measured 16 to 17 lines long by six wide—about 32 to 34 by 12 mm. This indicates the rather slender form of northern Africa, Sicily and southern Italy as the typical *algira*. In this form the first $\frac{3}{4}$ whorl, or nearly that, is quite smooth, elevated and convex; then fine, regular, slightly arcuate rib-striae begin, very weak at first, but soon becoming stronger; they weaken near the lower suture; this sculpture continues to the middle of the third whorl (the embryonic shell being composed of $2\frac{1}{2}$ whorls), where it gives place to the more irregular sculpture of the neanic stage. A narrow but distinct ridge borders the suture of the embryonic whorls, running upward nearly to the apical end of the suture; below this ridge the whorl is slightly concave. Pl. 31, fig. 2, represents the apex of a specimen from Pæstum, Italy. The columella is usually more concave than in var. *cornea*. Fig. 4, copied from Kobelt, represents a Sicilian shell.

Bulimus algirus BRUG., Encycl. Méth., p. 364, no. 110, 1792 (Algiers).—BOURGUIGNAT, Malac. de l'Algerie, ii, p. 119, pl. 7, f. 1-12 (1864).—KOBELT, Iconogr., v, p. 55, pl. 134, f. 1314, 1316; n. F., xi, pl. III (map of distribution).—*Achatina boreti* GRAY, Ann. of Philos., ix, 1825, p. 414.—*G. algira* var. *intermedia* Martens, Malak. Bl. für 1859, vi, p. 161 (Sicily).—*Helix poireti* FÉR., Tabl. Syst. 1822, p. 50, no. 358, based on Bruguiere's *B. algirus*.—(?) *Glandina algira* var. *bonensis* ALBERS, Die Hel. 1860, p. 27 (undescribed).—*Poiretia algira* var. *pseudoalgira* SACCO, I Molluschi dei terreni Terziarii del Piemonte, etc., pt. 22, p. 57, pl. 4, f. 86 (March, 1897).

"*Polyphemus striatus* Montfort, Conch. Syst., ii, p. 415," has been cited as a synonym of *algira* by Raymond, Journ. de Conchyl. iv, p. 15. The name does not occur in Montfort's work.

1a. Var. DILATATA ('Ziegl.' Pfr.). Pl. 31, fig. 3.

The shell is ovate-conic, broader and more inflated than *algira*, with the spire shorter, aperture much larger. Length 36, diam. 14, aperture 20x9 mm., or longer, some Algerian examples as large as 46x20 mm.

Sicily (type loc.); Algeria; southern Italy.

Achatina dilatata Zgl. mus., PFR., Monogr., ii, p. 289 (1848); Conchyl. Cab., p. 306, pl. 17, f. 19-21.—*Polyphemus tumidus* Pfeiff., VILLA, Dispositio Systematica Conch. terr. et fluv. in coll. Villa, p. 19 (1841), nude name.—*G. algira* var. *tumida* MARTENS *et al.*

The name *tumida*, adopted by some authors, has no standing, since it was not defined until long after Pfeiffer had described and figured *dilatata*. A fine series has been figured by Kobelt, Iconographie n. F., iii, p. 1, pt. 61. I copy the type figure. The radula has been figured by Henking (Zoologische Jahrbücher viii, 1895, p. 88). It has 18,1,18 teeth. The animal preyed on *Rumina decollata*.

1b. Var. SICULA (Bgt.).

"A species special to Sicily, characterized by a very long spire, relatively very short aperture, and especially by the

very much arched columella, which is less abruptly truncate'' (Bgt., Malac. de l'Algerie, ii. p. 117, 1864).

Westerlund considers var. *microstoma* Kobelt and var. *pyramidata* Paulucci synonyms of *sicula*. A comparison of the types should be made.

Var. *microstoma* Kobelt (pl. 31, fig. 1). Columella very strongly concave; aperture very short, only 16 mm. long in a shell of 42 mm. The truncation of the columella is much less strong than in var. *cornea*. (*Glandina algira* var. *microstoma* Kobelt, Iconogr., v, p. 57, pl. 134, f. 1313, 1877.)

Grecian forms of the algira-dilatata type. Mousson, von Martens and others have reported *dilatata* from various insular localities in or adjacent to Greece. Two names have been based upon examples from that region, *delesserti* Bgt. and *marginata* Westerl. The exact relationships of these forms to one another and to Italian *dilatata* remain to be worked out.

1c. Var. MARGINATA (Westerlund).

Suture accompanied by a strongly raised line, smooth and olive-colored above, then white and strongly crenate (Westerlund: *G. dilatata* var. *marginata*, Fauna Paläarctischen Region Binnenconch., i, p. 10, 1886).

Crete.

1d. Var. DELESSERTI (Bourguignat). Pl. 31, figs. 5, 6, 7.

Shell solid and strong, the last whorl somewhat saccate; embryonic shell (fig. 5) with *lower, more convex whorls* than in Italian or Sicilian forms of *P. algira*, forming a *larger, more obtuse apex*. Columella very concave.

Length 40, diam. 14.7, aperture 20.5 mm.; whorls $6\frac{1}{4}$.

Length 35.3, diam. 13.7, aperture 17 mm.; whorls 6.

Greece: Corfu (N. Conemenos).

Glandina delesserti Bgt. (Testacea Novissima, etc., p. 19, Aug. 1852), from Corfu, has been stated by that author to be identical with *compressa*, but the measurements (alt. 9, diam. 5, length of aperture 7 mm., whorls 4) do not bear out

this statement. Kobelt believes it referable to var. *dilatata*. It was based on a young shell, the adult form of which is described above. The embryonic shell differs from all Italian forms I have seen, and indicates, in my opinion, a well-marked subspecies, probably confined to Corfu.

1e. Var. MINGRELICA (Boettger). Vol. I, p. 42.

Transcaucasia. Similar to *P. cornea* in shape but with a smaller apex, and with sculpture of much coarser rib-striæ, the intervals nearly double the width of the riblets, giving place on the last whorl to coarse wrinkle-striation. Length 34 to 36, diam. 10.5 to 11, aperture 15 to 16 mm., whorls 7. (*Glandina algira* var. *mingrelica* Bttg., Jahrb. d. Malak. Ges., viii, 1881, p. 170, pl. 7, f. 1).

I have not seen this form. Its rank and position depend upon the sculpture of the embryonic shell, which has not been described.

2. P. CORNEA (Brumati). Pl. 31, figs. 8, 9.

Shell thin, very slender and long, lanceolate-fusiform, blue-white under a very thin, fugitive olive-yellowish cuticle. The embryonic shell consists of from slightly over 2 whorls to $2\frac{1}{3}$. The first whorl is smooth, except that on its last half fine, short striæ appear below the suture. These gradually become longer, and on the latter part of the last embryonic whorl part of the striæ weakly reach to the suture below. The subsutural thread or cord is distinct, but less prominent than in *P. algira*. The post-nepionic whorls of the spire are sculptured with strong, regular rib-striæ, but these weaken and become irregular on the last whorl or half whorl, which is irregularly wrinkled. The suture is irregularly crenulate, and very oblique, but its descent is nearly regular, not much more oblique at the last half whorl. The columella is rather strongly concave near the base, which is abruptly truncate.

Length 36.5, diam. 11, aperture 17.5 mm.; whorls $5\frac{3}{4}$.

Length 33.5, diam. 10.5, aperture 16 mm.; whorls $5\frac{3}{4}$.

Dalmatia and adjacent territories on the northeastern

shores of the Adriatic Sea. Type locality Monfalcone; figured specimens from Zara.

Achatina cornea BRUMATI, Catalogo systematico della Conchiglie terrestri e fluviatili osservate nel Territorio di Monfalcone, p. 35, fig. 5 (1838).—*Polyphemus algirus* var. *angustatus* VILLA, Disposit. Syst., etc., p. 19, no description (1841).—*Achatina poireti* ROSSMAESSLER, Iconogr., i, 2 Heft, p. 18, pl. 7, f. 123 (1835).—*Glandina algira* var. *compressa* MOUSS., KOBELT, Iconogr., v, p. 57, pl. 134, f. 1315.

P. cornea has commonly been known as *Glandina poireti* Fér., but that was originally defined solely by a reference to Bruguiere's *B. algirus*; therefore the name cannot be used for the form which Férussac figured in his later publication (Hist. nat. Moll.), as Rossmässler, Bourguignat and others have done.

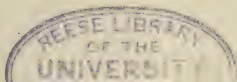
3. *P. COMPRESSA* (Mousson). Pl. 31, figs. 10, 11, 12, 13.

Shell oblong-cylindric, involute, thin, diaphanous, closely costulate-striate, pale or whitish under a very fugitive epidermis. Spire cylindric-turrite, the apex rather obtuse; suture irregularly crenulate and submarginate. Whorls 5, very rapidly increasing, flat in the middle, the last whorl long, descending, as long as the spire, impressed at its upper third. Columella slightly arcuate or straight, abruptly truncate. Aperture acutely piriform, somewhat wider below; peristome unexpanded, acute, arching forward in its upper third, the margins joined by a thin callus. Length 35, diam. 11, aperture 16x7 mm. (Mouss.).

Greece: Corfu, type loc.; Cephalonia, Iania (Dr. Schläfli); Patras (Conemenos).

Glandina compressa MOUSS., Coquilles terrestres et fluviatiles recueillies dans l'Orient par M. le Dr. Alex. Schläfli, in Vierteljahrsschrift der Naturforschenden Gesellschaft in Zürich, iv, 1859, pp. 21, 260, 271, and as "*G. depressa*," p. 33.—WESTERLUND and BLANC, Aperçu sur la Faune Malac. de la Grèce, 1879, p. 22.

The original description is given above. Specimens before me are not so large, some measuring—



Length 32, diam. 9, aperture 16 mm.; whorls $5\frac{1}{4}$.

Length 30, diam. 8.5, aperture 15 mm.; whorls $5\frac{1}{4}$.

Length 28, diam. 9.5, aperture 14 mm.; whorls 5.

The shell is even slimmer and more obliquely coiled than *P. cornea*, the last half-turn of the suture being very oblique to the preceding one above it. A more important difference is in the embryonic whorls, which are without the subsutural cord of *P. algira* and *P. cornea*. The first whorl is smooth and convex; fine striæ then gradually begin, rapidly becoming strong rib-striæ on the last half-whorl of the embryo. As in *P. cornea*, there are about $2\frac{1}{3}$ embryonic whorls.

Genus SALASIELLA Strebel.

Salasiella STREBEL, Beitrag zur Kenntniss der Fauna Mexicanischer Land- und Süsswasser-Conchylien, iii, 1878, pp. 6 (type *S. joaquina*), 29.—V. MARTENS, Biologia Centrali Americana Mollusca, p. 81 (1891).—*Selasiella* TRYON, Manual, i, p. 43.—*Selaniella* Strebel, ANCEY, Annales de Malacol., ii, p. 245 (1886).

The shell is small, oblong or fusiform, unicolorous, of glassy or corneous appearance, smooth or feebly striated, without spiral striæ; embryonic whorls smooth; columella truncated basally, as in *Euglandina*.

The radula has the formula 10,2,1,2,10. There is a well-developed central tooth; the inner two laterals are large and powerful, with broad basal-plates, the outer ones are slender, with narrow basal-plates of the usual sole-like shape (pl. 25, fig. 7, *S. joaquina*). Only one pouch-like stomach. Cerebral ganglia concentrated into one group. Genitalia (pl. 25, fig. 9, *S. joaquina*) with a curved finger shaped appendix (fig. 9, *gm*) near the base of the penis (*p*). Labial processes perhaps lacking. Type *S. joaquina*.

The species now known give this genus of minute Oleacinaid forms an extension from southern Guatemala to the state of Nuevo Leon in northeastern Mexico. Two species were described and figured in vol. I of this work.

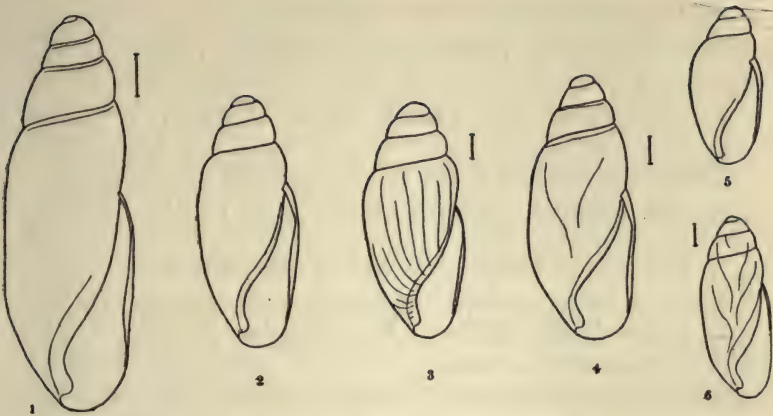


Fig. 1. *Salasiella subcylindrica*. Diente, near Monterey.

Figs. 2, 3. *Salasiella perpusilla*. Diente, near Monterey.

Fig. 4, 5. *Salasiella modesta*. Orizaba.

Fig. 6. *Salasiella minima*. Orizaba.

(All figures drawn with camera lucida to the same scale.)

1. *S. MARGARITACEA* (Pfeiffer). Pl. 28, fig. 61.

Shell oblong, thin, smoothish, very lightly and irregularly plicatulate under the lens, pellucid, glossy, transparent-yellowish. Spire short, conic, rather acute; suture somewhat channelled, margined. Whorls $5\frac{1}{2}$, a little convex, the last more than half the total length, slightly tapering basally. Columella slightly arcuate, abruptly truncate. Aperture vertical, acuminate-semioval; peristome simple, the right margin slightly arching forward. Length 9.5, diam. 3.33, aperture 7×2 mm.

Mexico: Cordova, State of Vera Cruz (Salle, in Cuming collection).

Achatina margaritacea PFR., P. Z. S. 1856, p. 321.—*Oleacina m.*, PFR., Monogr., iv, p. 636.—*Salasiella m.*, Pfr., MARTENS, Biologia, p. 81, pl. 5, f. 8.

"Very distinct from its coniform shape, thus resembling many *Streptostylæ*, but the conformation of the columella is that of *Glandina*. The figure here given is drawn from a specimen in the late Mr. Paetel's collection, of somewhat smaller size than Pfeiffer's example" (v. Marts.).

2. *S. JOAQUINÆ* Strebel. Vol. I, p. 43.

This species was described from Jalapa, Vera Cruz (*cf.* Strebel, *Beitrag*, iii, p. 29, pl. 9, f. 6; pl. 10, f. 1-7; pl. 11, f. 8). Specimens were taken by Mr. S. N. Rhoads at Diente, near Monterey, Nuevo Leon. Strebel's types measure:

Length 8.3, diam. 3.4, length of aperture 5.3, whorls $4\frac{3}{4}$.

Length 8.5, diam. 3, length of aperture 5.1, whorls 5.

3. *S. MODESTA* (Pfeiffer). Page 171, figs. 4, 5.

Shell minute, subfusiform-oblong, thin, smooth, marked with a few impressed striæ; pale corneous, pellucid. Spire conic, somewhat acuminate; suture light, submargined. Whorls 5, a little convex, the last somewhat longer than the spire, somewhat tapering basally. Columella arcuate, horizontally truncate a short distance above the base. Aperture slightly oblique, acuminate-oval; peristome simple, the right margin slightly dilated forwards. Length 4, diam. 1.5, aperture 3.25 mm. (*Pfr.*).

Mexico: State of Vera Cruz at Mirador (Strebel); Orizaba (Heilprin expd.).

Oleacina modesta PFR., Malak. Bl., ix, 1862, p. 98; Monogr. Hel. Viv., vi, p. 275.—*Glandina modesta* Pfr., FISCHER and CROSSE, Miss. Scient. au Mex., Moll., i, p. 135.—STREBEL, *Beitrag*, ii, p. 52, pl. 13, f. 49.—*Salasiella m.*, STREBEL, *l. c.*, iii, p. 30, pl. 9, f. 9.—PILSBRY, Proc. A. N. S. Phila. 1903, p. 773, figs. 4, 5.—*Glandina (Salasiella) perpusilla* PILS., Proc. A. N. S. Phila. 1891, p. 311.

Figs. 4, 5 represent an adult and a young example from Orizaba, the former measuring, length 3.7, diam. 1.47, aperture 2.1 mm.

4. *S. MINIMA* Pilsbry. Page 171, fig. 6.

Very minute, cylindric-oblong, almost equally obtuse at both ends; thin, corneous and transparent, showing the internal partitions through the shell. Surface glossy and but very faintly marked with growth-lines. Whorls 4; suture with a narrow margin by transparence. Other characters as usual in the genus. Length 2.6, diam. 1, length of aperture 1.6 mm.

Mexico: hills around Orizaba, about 500 feet above the town. Type no. 58070, A. N. S. P., collected by Witmer Stone, of the Heilprin expedition of 1890.

Salasiella minima PILS., Proc. A. N. S. Phila. 1903, p. 773, fig. 6.

This smallest species of the genus is not unlike *S. modesta* in shape, but it is built on a much smaller scale. For comparison I figure a young specimen of *S. modesta*, the different contour of which may be readily appreciated.

5. *S. PERPUSILLA* (Pfeiffer). Figures 2, 3, page 171.

Manual, vol. I, p. 43. This species is more convex below the suture than *S. modesta*, *minima* or *subcylindrica*. The figures here given represent specimens from Diente, the original of fig. 3 measuring, length 3.3, diam. 1.4, length of aperture 1.9 mm.

Guatemala (Stoll); Mirador and Jalapa, State of Vera Cruz, and Diente, near Monterey, State of Nuevo Leon.

6. *S. PULCHELLA* (Pfeiffer). Pl. 28, fig. 62.

Shell oblong, rather thin, smoothish, seen under the lens to be arcuately and irregularly striatulate, glossy, corneous-whitish, obsoletely streaked with buff. Spire convexly conic, rather acute, with a narrowly margined suture. Whorls 6, moderately convex, the last scarcely two-thirds the total length, somewhat tapering basally. Columella somewhat straightened, narrowly truncate. Aperture vertical, sinuate-semioval, long-acuminate; peristome simple, the right margin slightly dilated forward. Length 10.5, diam. 3.75, aperture 7x2 mm. (*Pfr.*).

Mexico: Chiapas (Ghiesbreght, in Cuming coll.).

Oleacina pulchella PFR., Malak. Blätter, iii, p. 234 (printed in Dec., 1856, apparently issued in January, 1857); Monogr., iv, p. 635.—*Achatina pulchella* PFR., P. Z. S. 1856, p. 379 (May 8, 1857). Not *Achatina pulchella* Spix, 1827.—*Salasiella p.*, MARTENS, Biologia, pp. 83, 613, pl. 5, f. 9.—*Salasiella pfeifferi* PILSBRY, Proc. A. N. S. Phila. 1899, p. 398.

Prof. von Martens' figure of the type in the British Mu-

seum is copied. He records the species from Turabares, southwestern Costa Rica, taken by Biolley. I proposed the name *S. pfeifferi* as a substitute for *Achatina pulchella* Pfr. not Spix, but on further investigation I find that Pfeiffer first described the species as an *Oleacina*, and hence the name was not preoccupied.

7. *S. SUBCYLINDRICA* Pilsbry. Fig. 1, page 171.

Shell distinctly cylindric, the rather long spire tapering to an obtuse apex; corneous-white; smooth except for a few impressed lines following the direction of growth-lines. Whorls $4\frac{3}{4}$, slightly convex, the last flattened peripherally. Suture margined by transference. Aperture of the usual shape; outer lip strongly arched forward in the middle, retracted above and below. Columella as in other species of the genus. Length 5.6, diam. 1.8, length of aperture 3.15 mm.

Mexico: Diente, near Monterey, State of Nuevo Leon. Types no. 77169, A. N. S. P., collected by S. N. Rhoads, 1899.

Salasiella subcylindrica PILS., Proc. A. N. S. Phila. 1903, p. 774, fig. 1.

This species is larger and more cylindric than *S. modesta*, and the columella is less concave. Its contour is quite unlike that of *S. perpusilla*, which also occurred at Diente.

8. *S. ELEGANS* v. Martens. Pl. 28, figs. 58, 59.

Shell long-turrite, slightly striatulate, not at all granulose, very glossy, uniform corneous. Spire obtusely convex. Whorls 8, a little convex, separated by a moderately impressed suture, the last slowly tapering below. Aperture slightly oblique, irregularly lanceolate; peristome thickened throughout, white, the outer lip convexly produced above, receding below; basal margin rounded; columellar margin much thickened, deeply emarginate, as in *Glandina excavata* Marts., broadly obliquely truncate at the base. Length 11.5, diam. 3.5, aperture 4 mm. (*Martens*).

Southwestern Mexico: Colima (Rolle).

Salasiella elegans VON MARTENS in Rolle, Nachrichtsbl. deutsch. malak. Ges., August, 1895, p. 129; Biologia, p. 613, pl. 44, f. 1, 1a (1901).

Genus EUGLANDINA Crosse et Fischer.

Euglandina C. & F., Mission scientifique au Mexique et dans l'Amerique Centrale, Mollusques, i, 1870, p. 97; first species *Glandina lignaria*.—FISCHER, Manuel de Conchyl., p. 452; type *G. lignaria*.—*Glandina* STREBEL, Beitrag zur Kenntniss der Fauna Mexikanischer land- und süßwasser-Conchylien, ii Theil, 1875, pp. 4-58.—v. MARTENS, Biologia Centrali Americana, Mollusca, pp. 46-80.—*Pfaffia* BEHN, Amtlicher Bericht über die 22 Versammlung deutschen Naturforscher und Aerzte in Bremen, Sept. 1844, 2te Abth., p. 131 (1845), no type.

The shell is usually of large or moderate size, oblong, fusiform or ovate, typically with striate or decussate surface and without distinct varices; but in some forms the surface is smooth, and sometimes varices are present. Columella abruptly truncate at the base; outer lip unexpanded, simply arched forward or straight. Whorls 6 to 9.

Type *E. aurata* var. *lignaria* Rve. Distribution, American mainland, from Brazil to Texas, Florida and South Carolina.

Euglandina differs generically from *Oleacina* and *Poiretia* by characters of the genitalia. See Introduction to this volume.

The name *Glandina*, commonly used for this group, was based solely upon *G. voluta*, the type of the prior genera *Polyphemus* Montfort and *Oleacina* Bolten. It is therefore inapplicable to the Mexican and other mainland species, if, as I believe, these differ generically from Antillean groups. *Pfaffia* was proposed for an undetermined Mexican snail said to be related to *Polyphemus glans* Say; but no adequate generic characters are given, and it would be impossible to determine its type.

The Mexican and Central American *Euglandinas* present problems of great difficulty, the species being very similar and at the same time variable. The shape and sculpture of the embryonic whorls are among the most important characters, but these are unknown in many species. The critical studies of Strebel form the basis for a really scientific knowl-

edge of the forms; their value can hardly be overestimated. Crosse and Fischer and von Martens have contributed indispensable material of great value, yet from the standpoint reached by Strebel, it must be admitted that all other authors have treated the subject in a comparatively superficial manner. Since most of the species were included by Mr. Tryon in Vol. I of this work, I have restricted the following account to strictly supplementary matter.

I. TYPICAL FORMS OF EUGLANDINA.

South American Species.

1. *E. STRIATA* (Müller). Vol. I, p. 32.

In his latest treatment of this species (*Biologia Centrali Americana*, p. 79) Prof. von Martens includes as synonyms *Glandina strigosa* Marts. (vol. I, p. 33) and *G. lineata* Strebel (I, p. 32). It extends from southern Brazil to Colombia and Guiana, but is probably not homogeneous over so wide and varied a range, the examples before me showing considerable diversity.

2. *E. FLOCCATA* (Da Costa). Pl. 20, fig. 10.

Shell fusiform with long spire, thin, ventricose; pellucid-brownish with remote chestnut streaks, and sparsely flecked with rather indistinct whitish spots. Whorls 8, longitudinally very closely plicate-striate, at the suture finely and very closely crenulate. Columella arcuate, conspicuously truncate. Aperture rather ample, brownish-white. Length 89, diam. 35, aperture 46x18 mm. (*Da Costa*).

Colombia: La Armenia, near Bogotá.

Glandina floccata DA COSTA, Proc. Malac. Soc. Lond., iv, p. 66, pl. 7, f. 3 (August 1, 1900).

"This fine species bears a strong resemblance to *G. striata* Müll; the last whorl, however, is rather more ventricose, and exhibits a feature never found in that species, viz., the presence of several white flecks scattered irregularly over the body-whorl: the only other instance of similar spotting may be observed in examples of *G. vanuxemensis* Lea, from Mexico" (*Da Costa*).

3. *E. TRUNCATA* (Gmelin). Pl. 21, figs. 4, 10, 11, 12.

"A thin, uniform white shell, with the appearance of a land snail. It is composed of 7 whorls and is similar in form to the preceding [*Liguus*] but more lengthened. The whorls are somewhat convex, the uppermost forming an obtuse apex. The aperture is not very wide, its length more than twice its breadth, and almost half the length of the shell. The columella runs far forward in a strong curve, and forms a channel, of which its truncate end is the outlet. The growth-marks are very noticeable. They pass over the whole shell, like fine striæ, and their end points are cut off as by a seam at the foot of the whorls, forming small notches. The shell is 2 inches 6 lines long, and nearly 1 inch wide."

Venezuela (Ed. Müller); near Yucacas, and woods of Arva (C. F. Starke).

Das weisse Kinkhorn mit abgestumpfter Spindel, KAEMMERER, Die Conchylien im Cabinet des Herrn Erbprinzen von Schwartzburg-Rudolstadt, p. 128, pl. x, f. 5 (1789).—*Bulla truncata* GMELIN, Syst. Nat. (13), p. 3434, no. 49 (1790).—*Glandina subvaricosa* ALBERS, Malak. Bl., i, 1854, p. 220.—MARTENS, Binnenmoll. Venez., p. 164.—*Achatina s.*, PFR., Novit. Conch., i, p. 34, pl. 9, f. 6, 7.—*Oleacina s.*, PFR., Monogr., iv, p. 631.—TRYON, Manual, i, p. 38.

Gmelin's name *B. truncata* was based solely upon the description and figure of Kämmerer. The former is reproduced above. The figure is a very good representation of what Albers called *G. subvaricosa*. The dimensions given by Kämmerer are almost exactly those of Albers' type. *B. truncata* has been thought to apply to the Floridian species (*E. rosea* Fér.), but the shape of the spire and columella, and the crenated suture, show that it was based upon the South American species, and certainly not upon the Floridian.

The shell is unusually thin, light dull-brown, with a few former growth-stages marked by pale or whitish streaks, and sometimes followed by darker brown streaks. The first whorl is quite planorboid above; the next has a characteristic form, having a narrow shoulder and then flatly sloping outward.

Near the end of the second whorl some malleation appears, and then fine, regular striation gradually begins (pl. 21, fig. 4). The last whorl is closely, rather irregularly plicatulate, and covered with a very fine, close sculpture of engraved spirals. The spire is straightly conic, the suture crenulate, with a whitish seam-like border, the ends of the plicæ being swollen, single or a few of them in pairs, and defined by an impressed groove, more or less distinct. The columella is always very concave.

Length 61, diam. 23, aperture 31 mm. (Albers).

Length 63, diam. 25.5, aperture 31.5 mm. (Arva).

Length 53.5, diam 23.5, aperture 28.6 mm. (Yucacas).

The specimens figured are from Arva (fig. 10) and from near Yucacas (figs. 4, 11, 12).

4. *E. SWIFTI* Pilsbry, n. sp. Pl. 21, figs. 1, 2, 3.

The shell is long and narrow, solid and opaque, without noticeable cuticle, having the nude appearance of *E. rosea parallela*. It is flesh-colored, with whitish streaks at wide, unequal intervals, darker in front of the streaks. The long spire has nearly straight outlines and obtuse apex. The embryonic shell resembles that of *E. truncata* Gmel. (*G. subvaricosa* Alb.) in shape of the first two whorls, the first being planorboid, the second subangular at the shoulder, flattened above it, flatly sloping and malleate below. Near the end of the second whorl very fine, regular striation begins, continuing to the end of the embryonic shell, which consists of $3\frac{1}{2}$ whorls. After this, the whorl widens rather abruptly, the sutural nodules appear, and spiral striation becomes distinct (pl. 21, fig. 3). The last whorl has sculpture of coarse, irregular longitudinal folds, cut by very fine engraved spirals. The folds are swollen into grains at the sutural border, which is defined by a groove. The suture is crenulated (fig. 2). The aperture is long and narrow, vertical. The columella is concave above, then nearly straight, broadly and horizontally truncate at its base.

Length 64.5, diam. 22, aperture 30 mm.; whorls $7\frac{1}{2}$.

Length 61.3, diam. 22, aperture 28.6 mm.; whorls $7\frac{1}{2}$.

Venezuela: mountains near Coro (Capt. Foster).

This species resembles *E. rosea parallela* in its solid texture, and *E. liebmanni* in the coarse sculpture. In the fine spiral sculpture and the embryonic whorls it differs widely from both, and is related to *E. truncata* Gmel. (*subvaricosa* Alb.). From the latter it differs by the solid texture, coarser sculpture, narrower form and much less concave columella. Based upon four specimens, taken Aug. 14, 1864. The collector notes that the upper tentacles are darker than the other parts; the back is dark ash color, the sides and foot almost white. Named in honor of Robert Swift, whose rich collection of South American and Antillean mollusks was devised by him to the Academy.

5. *E. DISTINGUENDA* (Tryon). Vol. I, p. 36, pl. 8, f. 13.

Glandina aurata STREBEL, Beitrag Mex. Land- und Süswasser Conchylien, ii, p. 21, pl. 2, f. 36-37; pl. 12, f. 36, 36 a, b, 37 a-d (1875). Not of Morelet. — *Oleacina distinguenda* TRYON, Manual I, p. 36, pl. 8, f. 13 (January, 1885). — *Glandina stübeli* v. MARTENS, Biologia Centrali Americana, Mollusca, p. 57 (April, 1891).

Colombia: Oeana (Wallis).

The names proposed by Tryon and by von Martens were both based solely upon the full account given by Strebel, who, in the absence of material for comparison, identified the Colombian form with *aurata*. Tryon carelessly gave the locality "Mexico." The spiral sculpture seems to resemble the Mexican rather than other South American species.

6. *E. BOGOTENSIS* (Da Costa). Pl. 20, fig. 7.

Shell fusiform, rather thick, glossy, purplish-chestnut. Spire long. Whorls 7, a little convex, longitudinally very closely plicate-striate, under the lens minutely transversely striate, at the suture finely crenulate and narrowly margined. Columella almost straight, whitish, conspicuously truncate. Aperture rather small, purplish-chestnut, lip pallid, somewhat thickened at the edge. Length 51, diam. 21, aperture 21x10 mm. (*Da C.*).

Colombia: Bogotá.

Glandina bogotensis DA C., Proc. Malac. Soc. Lond., vi, p. 6, pl. 1, f. 5 (March, 1904).

"It is closely allied to *G. æquatoria* Da Costa, from Ecuador, but is more fusiform, thinner, has a whorl less, and is without the transverse striation of that species."

7. *E. SACCATA* (Pfeiffer). Pl. 20, figs. 5, 6.

Vol. I, p. 39. There are $3\frac{1}{2}$ embryonic whorls, the first two smooth; then very fine, close and delicate striæ appear below the suture, gradually increasing in length until on the last embryonic half whorl they extend to the suture below. The neanic and adult sculpture consists of rather coarse riblets occasionally forked, and on the last whorl about seven to ten in the space of 5 mm. An impressed subsutural groove cuts the riblets, defining a distinct margin about 1 mm. wide, with sculpture of oblong granules, each formed by the end of a riblet. The suture itself is irregularly crenulate. At the periphery the riblets rather abruptly fade out, leaving a much smoother, only irregularly and very weakly plicatulate base. Very dense and fine incised spiral lines cover the last whorl throughout; on the penult. whorl they are weaker, and are nearly lost on earlier whorls. The columella is nearly straight, and the outer lip has a whitish edge. The specimen figured measures, alt. 55.3, diam. 24.3, aperture 27 mm. long, with 7 whorls. Pfeiffer's type is 56x24 mm. Ecuador.

8. *E. ECUADORIANA* (Miller). Vol. I, p. 40.

Related to *E. saccata*, but much more delicately plicatulate, with much finer spiral striation; suture coarsely crenulate, each granule occupying the breadth of two folds. The folds fork near the middle of the last whorl. 62x26 mm., aperture 30x12 mm. Val de Pilaton, Ecuador.

9. *E. ÆQUATORIA* (Da Costa). Pl. 20, fig. 9.

Shell fusiform-oblong, rather thick, glossy, purplish-chestnut; whorls 6, a little convex, longitudinally very closely plicate-striate, under the lens minutely transversely striate, at

the sutures delicately crenulate. Columella straight, abruptly truncate. Aperture ashy-chestnut, with a white peritreme. Length 59, diam. 27, aperture 30x12 mm. (*Da Costa*).

Ecuador: Peramba.

Glandina aequatoria DA COSTA, Proc. Malac. Soc. Lond., iv, p. 67, pl. 7, f. 4 (Aug. 1, 1900).

"Although closely allied to *G. saccata* Pfr., it is darker in color, smaller, and much thicker; the longitudinal plication is closer, and the transverse striation much finer; it has also a straighter columella" (*Da C.*).

This form needs comparison with *E. ecuadoriana* (Miller), which, from the description, must be very similar.

10. *E. ORNATA* (Pfr.). Vol. I, p. 32. Colombia.

11. *E. CALLISTA* (Pilsbry & Clapp). Pl. 20, fig. 11.

Shell fusiform, very thin, pale brownish-yellow with a few indistinct darker streaks, more numerous on the spire, and encircled by numerous narrow, inconspicuous buff spiral lines between the periphery and suture and on the spire. Surface but slightly glossy, sculptured with fine, somewhat irregular striæ, and weakly scored by fine, close spiral striæ, better developed below. Suture distinctly margined with a row of small bead-like folds, each formed usually by the coalescence of two, or the knob-like enlargement of one of the striæ. Spire acuminate. Whorls nearly 7, but slightly convex, the last more inflated, tapering below. Aperture slightly oblique, four-sevenths the length of the shell; outer lip evenly arcuate; columella very concave, truncate as usual below. Parietal wall covered with a very thin wash of callus, which swells broadly out upon the whorl in the middle, and is abruptly retracted above. Length 68.5, diam. 26 mm.; length of aperture 38, greatest width 15.5 mm. (*P. & C.*).

Colombia: Santa Marta Mts. at Valparaiso, in forest at 4,500 ft. elevation (H. H. Smith).

Glandina callista P. & C., Nautilus, xv, p. 133, pl. 7, f. 7 (April, 1902).

"A charming species, remarkable for its acuminate spire,

fusiform contour and thin texture. It differs from *G. striata* by its sculpture and the absence of distinct dark varices. *G. plicatula* is a smoother, more obese shell, with shorter aperture. No other South American species is nearly related."

12. *E. PLICATULA* (Pfeiffer). Pl. 28, figs. 63, 64.

Shell oblong-fusiform, thin, longitudinally closely plicatulate, obsoletely decussated with spiral lines, diaphanous, slightly shining, brownish flesh-colored. Spire long-conic, the apex obtuse, suture margined, minutely crenulate. Whorls 7, a little convex, the last as long as the spire, somewhat more convex, tapering at the base. Columella callous, slightly arcuate, abruptly truncate at the base of the semioval aperture, which is very glossy inside. Peristome simple and thin. Length 60, diam. 25, aperture 31×13.5 mm. (*Pfr.*).

Colombia: in the Andes (Cuming coll.); Ocaña and Sonson (Wallis); Cauca (Fortunato Bonis).

Achatina plicatula PFR., P. Z. S. 1851, p. 258 (Andes of Colombia); Monogr., iii, 517; Conchyl. Cab., p. 319, pl. 26, f. 2.—*Oleacina p.*, TRYON, Manual I, p. 37, pl. 7, f. 96 (copied from Pfr.).—*Glandina p.*, form B, STREBEL, Beitrag, ii, p. 20, pl. 6, f. 33, *a-e*, f. 34 *a, b*.—MOUSSON, Malak. Bl., xxi, 1873, p. 15.—MARTENS, Biologia Centrali Amer. Moll., p. 80.

In typical *E. plicatula* the spire is straightly conic, its outlines not concave near the apex; the color is reddish-brown, darker towards the summit. The outer lip is drawn forward near its upper insertion, and the columella is moderately concave, less so than in the Venezuelan race. Strebel gives the measurements of Sonson examples: length 60.5, diam. 27.5, aperture 33.25 mm., whorls $6\frac{3}{8}$, and 44, 19.75, 23.75 mm., whorls nearly $6\frac{1}{4}$.

An adult from Cauca, here figured, pl. 28, figs. 63, 64, measures, length 53.5, diam. 23.7, aperture 28 mm., whorls $6\frac{1}{3}$.

12a. Var. *CINNAMOMEOFUSCA* (Tryon). Pl. 20, fig. 8.

This handsome shell varies from reddish-cinnamon color to light yellowish-brown, with reddish early whorls. The spire

is somewhat attenuate or concave near the apex. The embryonic shell consists of $3\frac{1}{2}$ smooth, glossy whorls, the second more or less shouldered, malleate, and striate near the suture, the last embryonic whorl usually with a plicatulate sutural border. The last whorl has very fine, close striæ, generally forked a short distance below the suture, 4 or 5 in a millimeter at the periphery. These are cut by far finer engraved spiral lines. The sutural border is formed of oblong beads, in which the striæ run singly or in pairs. There are usually some white varix-streaks, often shaded with darker brown in front, and varying from one to three on each of the three later whorls. The outer lip is white-edged. The columella is very concave in adult shells, but in the young it is straight. Length 77, diam. 33, aperture 39 mm.; whorls $7\frac{3}{4}$.

Venezuela: Cumbre de San Hilario, and Chino, near San Felipe (Appun); Cumbre de Valencia (Dr. Kretz); San Esteban, near Puerto Cabello, Caracas (Lansberg); mountains between Pto. Cabello and Valencia (C. F. Starke).

Glandina plicatula Pfr., MARTENS, Die Binnen-moll. Venezuelas, Festschr. Ges. nat. Freunde Berlin, 1873, p. 164.—*G. plicatula*, form A, STREBEL, Beitrag, ii, p. 19, pl. 6, f. 35, *a-c*; pl. 1, f. 33 (apex).—*O. plicatula* var. *cinnamomeofusca* TRYON, Manual, i, p. 37.

The Venezuelan race, described above, becomes larger than *plicatula*, 70 mm. long or more, with a more produced spire, slightly concave near the summit; the columella is more concave, and the surface very glossy. It sometimes shows a few indistinct pale flecks, as noticed by Pfeiffer and repeated by Tryon. The whitish varices are indistinct and rare in some examples.

13. E. ISABELLA Pilsbry, n. n. Pl. 21, figs. 5, 6, 7, 8, 9.

The embryonic shell consists of about $3\frac{1}{2}$ whorls, and is elevated conic dome-shaped with broadly and roundly truncate top, reminding one of *G. cognata*. Its whorls are decreasingly convex, the first two increasing comparatively faster than the following; the first projects, and especially at the end, is somewhat elevated as in *G. petiti*, etc.; smooth and

glossy at first, fine longitudinal folds beginning on the third whorl. The shell is strong, though somewhat translucent. The later whorls are only moderately convex, the last is more obliquely coiled and somewhat widened below. The color is either reddish-yellow, becoming redder towards the apex, or yellowish-brown, darker towards the summit, the peristome always widely pale-colored, and the interior has a thin, somewhat roseate layer, which is narrowly and weakly thickened at the peristome. A glossy cuticle covers the shell. The sculpture consists of irregular, strongly developed, narrow longitudinal plicæ, which become weaker below on the last whorl, not all of them reaching the base, whilst they are sharp near the suture, which they do not quite reach, and are a little drawn back by a groove running close below the suture. There is, therefore, on the last whorl a narrowly-defined margined sutural border, not, or but weakly, thickened, while on the upper whorls the suture is bordered only by a narrow transparent band. When very strongly magnified, extremely fine, close, somewhat wavy but not deep spiral grooves may be seen, and in places very weak traces of long-granule sculpture. The columella stands vertical to the axis, is strongly arched and twisted, with a thread-like white thickening on the free margin, continued over the truncation. The parietal callus is distinctly defined but thin.

Length 34, diam. 13.75, aperture 15 mm.; whorls $6\frac{3}{4}$.

Length 32, diam. 14.5, aperture 16.25 mm.; whorls $6\frac{1}{2}$.

Colombia: Frontino (Wallis).

Glandina isabellina STREBEL, Beitrag, ii, p. 46, pl. 6 A, f. 40, a-c. Not *G. isabellina* Pfr.

This form is evidently distinct from *G. isabellina* (Pfr.). Strebel's description and figures are reproduced.

14. *E. CYLINDRUS* (Martens). Vol. I, p. 34. Upper Marañon, Colombia.

15. *E. LUCIDA* (Strebel). Vol. I, p. 34. Colombia.

16. *E. ASSIMILIS* (Reeve). Vol. I, p. 24. Venezuela.

Species of Mexico and Central America.

17. *E. HUINGENSIS* (Pilsbry). Pl. 23, figs. 25, 26, 27.

The shell is obesely oblong, thin, fleshy-brown, glossy, with short, conic spire and very obtuse summit. The first two whorls are almost wholly smooth, and enlarge very rapidly, the second whorl being disproportionately wide; then short, distinct plicæ appear below the suture, the rest of the surface being smooth for the next half whorl, after which the foldlets extend weakly and irregularly further down, as in the adult stage. The last whorl descends very rapidly, and has sculpture of rather strong, subregular folds denticulating the suture, but rapidly weakening downwards into low wrinkles. There is no spiral striation. Aperture subvertical, the outer lip very weakly arching forward in the middle. Columella deeply arcuate and abruptly truncate. Length 36, diam. 17, length of aperture 22 mm.; whorls $5\frac{1}{2}$.

Mexico: Huingo, State of Michoacan (Rhoads).

Glandina huingensis PILS., Proc. A. N. S. Phila. 1903, p. 770, pl. 47, f. 2, 2 a, b.

With some resemblance to *E. indusiata*, this species differs by the absence of spiral sculpture. Though the suture is sharply denticulate, the last whorl, except close to it, is nearly smooth. The increase of the whorls is very irregular, the second whorl being abnormally wide, the third much narrower, and finally the last whorl descends rapidly, the last suture being quite oblique to the preceding. I know of no closely related species. The length was wrongly given in the original description. Figures and description are from the type.

18. *E. INDUSIATA* (Pfr.). Vol. I, p. 41 ("*indusiaca*").

19. *E. VANUXEMENSIS* (Lea). Vol. I, p. 39 ("*vanuxemii*").
Includes *A. coronata* Pfr., vol. I, p. 37; var. *guttata* C. et F., vol. I, p. 37.

20. *E. MICHOCANENSIS* (Pilsbry). Pl. 22, figs. 16, 17.

Shell obesely fusiform, rather thin, of a dull red color,

darker red on the spire, more yellowish towards the base, the suture with a pale border about 1.5 to 2 mm. wide on the last whorl, surface somewhat glossy, sculptured with coarse irregular plicæ, strongest near the suture, which they irregularly crenulate, and with finer folds which are cut into oblong grains in spiral series, as in *E. vanuxemensis*. This sculpture becomes weaker below the middle of the last whorl and is obsolete at the extreme base. The spire is conic with quite obtuse apex. The first $2\frac{1}{2}$ whorls are smooth and moderately convex; then vertical riblets begin, very weak at first, but becoming strong and regular, with smooth intervals; at the end of $3\frac{3}{4}$ whorls, marking the limit of the embryonic stage, the whorl widens more rapidly and the woven sculpture-pattern of the adult stage begins. The aperture is rather small, slightly oblique; outer lip hardly arching forward. The columella is only slightly concave either in front or profile views, and is abruptly truncate basally. Length 49.6, diam. 21.2, length of aperture 26 mm.; whorls $7\frac{1}{2}$.

Mexico: Uruapam, State of Michoacan (Rhoads).

Glandina michoacensis PILS., Proc. A. N. S. Phila. 1899, p. 397; 1903, p. 770, pl. 47, f. 1, 1 a, b.

This fine species has sculpture like *E. vanuxemensis*, but it differs from that by its smaller aperture, less concave columella, and especially by the embryonic shell, which has a long smooth-ribbed stage, and consists of more whorls than that of *E. vanuxemensis*. The type specimen is described and figured.

21. *E. SOWERBYANA* (Pfr.). Vol. I, p. 36. Var. *ESTEFANIE* Strebel, p. 36.

22. *E. COULTERI* ('Gray,' Pfr.). Pl. 22, figs. 22, 23, 24.

Shell oblong-conic, thin, longitudinally plicate and decussated with close spiral striæ, flesh-colored irregularly marked with non-projecting brown-margined white varices. Spire conic, rather obtuse; suture elegantly crenulate with white. Whorls 8, slightly convex, the last a little longer than the spire, longitudinally striated below the middle, not decussate

there, somewhat tapering towards the base. Columella arcuate, broadly truncate. Aperture subvertical, oval, narrowed above, acuminate; peristome simple, the right margin deeply sinuate above. Length 90, diam. 30, aperture 57x17 mm. (*Pfr.*).

Mexico: Zimapan (Davison); Puebla (Berkenbusch); Jalapa (Smith).

Glandina coulteri Gray, BECK, Index Moll., p. 78, no description.—MARTS., Biologia, p. 56, pl. 2, f. 4 a-c.—*Oleacina coulteri* Gray PFR., Monogr., iv, p. 642.—*G. uhdeana* MARTS., Monatsber. Akad. Berlin 1863, p. 540.—STREBEL, Beitrag, ii, p. 11, pl. 4, f. 6; iii, p. 7.

The figures are from von Martens. Fig. 23 represents a specimen from Jalapa; fig. 24 a very large one from Zimapan. This species was omitted from vol. I as unfigured. Beck refers to a plate of Gray's *Spicilegia Zoologica*, which seems never to have been published.

23. *E. CUNEUS* (v. Martens). Pl. 22, figs. 18, 19, 20, 21.

Shell conoid-oblong, narrowly saccate, sculptured with close costulae and rather distant impressed spiral lines; tawny-brown, rather glossy, thin. Whorls 6 to 6½, the spire rather obese, the apex obtuse; suture distinctly oblique, slightly crenulate. Aperture lanceolate, more or less exceeding half the total length, the columellar margin arcuate (*Marts.*).

Length 49, diam. 19, aperture 29x12 mm.

Length 51, diam. 19, aperture 27x12.5 mm.

Southwest Mexico: Omelteme, State of Guerrero (H. H. Smith).

Glandina cuneus MARTS., Biologia, p. 56, pl. 3, f. 1, 2.

"I have figured two specimens (figs. 1, 2) because they exhibit remarkable differences in the relative size of the visible part of the upper whorls, the degree of obliquity in the suture, and the breadth of the aperture, the one being somewhat more involute than the other. In all other respects their specific qualities are the same. This is an interesting example of the individual variation in the genus *Glandina*, which renders the precise distinction of species so difficult and uncertain" (*Martens*).

24. *E. AURATA* (Morel.). Vol. I, p. 36 (*plus A. lignaria* Rve., p. 36).
25. *E. FUSIFORMIS* (Pfr.). Vol. I, p. 36 (syn. ? *G. binneyana* Pfr.). Var. *STRAMINEA* Tryon, p. 36 (syn. var. *miltochila* Martens, Biologia, p. 57).
26. *E. GHIESBREGHTI* (Pfr.). Vol. I, p. 40.
27. *E. DECUSSATA* (Desh.). Vol. I, p. 40. Guatemala. Delete the locality Texas, where it certainly does not occur.
28. *E. TENELLA* (Strebel). Vol. I, p. 40.
29. *E. CORNEOLA* (W. G. Binney). Pl. 24, figs. 43, 44, 45.

"Shell oblong-conic, thin, shining, horn color; whorls 7 to 8, longitudinally striate and covered with numerous revolving minute lines; suture slightly crenulated. Aperture oblong, half as long as the shell; columella curved, truncated, covered with a light callus. Length 50, diam. 18 mm. Syn., *Glandina truncata* var., Binney non Gmel., Terr. Moll., iii, pl. 51, f. 1." (W. G. B.)

Northeastern Mexico: Valles (A. A. Hinkley).

Glandina truncata var., BINNEY, Terr. Moll., iii, pl. 51, f. 1. — *G. corneola* W. G. B., Proc. A. N. S. Phila. 1857, p. 189; Terr. Moll., iv, p. 139. — *G. decussata* Desh., W. G. BINN., Manual of Amer. Land Shells, p. 351, f. 379 (exclusive of part of synonymy).

This species was based on the specimen figured in *Terrestrial Mollusks*, vol. iii, the locality of which was unknown. Subsequently Mr. Binney gave the localities "western Texas" and "Mexico." The former probably applied to specimens of *E. singleyana*, since we have no satisfactory evidence that the true *E. corneola* occurs north of the Rio Grande.

Specimens have recently been taken by Mr. A. A. Hinkley at the town of Valles, State of San Luis Potosi, Mexico, inland from Tampico, illustrated on pl. 24, figs. 43-45. It is of a rather light brown color. The embryonic shell is conic with obtuse but small apex, composed of three smooth whorls. Some weak vertical wrinkles then appear, and about the middle

of the fourth whorl the spiral striæ set in. The last whorl is closely plaited, the plaits somewhat irregular, $2\frac{1}{2}$ to 3 in 1 mm. on the last whorl, sometimes dividing, and *very conspicuously cut by spiral grooves, which continue strong to the very base*, though the plaits weaken below the middle and are nearly obsolete at the base. The suture is weakly, irregularly crenated by the riblets, which terminate above in a border of oblong beads. The rather long, conic spire has very slightly convex outlines below, the summit being small for a *Euglandina* of this size. The columella is nearly straight. The figured example measures, length 39, diam. 15.7, aperture 22.7 mm.; whorls 7.

E. corneola is sculptured much more coarsely than *E. decussata*, the vertical plicæ being less regular and the spiral striæ coarser and much further apart. It, moreover, has not the peculiar columella of that Guatemalan species. The Texan *E. singleyana* is a much more finely, weakly sculptured shell, with feeble spiral striæ, concave columella and more obtuse apex.

30. *E. SINGLEYANA* (W. G. Binney). Pl. 24, figs. 48, 49, 50, 51.

The shell is quite elongate, thin, of a light brown color, quite glossy. The spire has convex outlines and a very obtuse rounded apex. The first $2\frac{1}{2}$ whorls are convex and nearly smooth, but under a strong lens very fine, faint growth-lines are visible; then stronger striæ appear, and on the fifth whorl spiral sculpture begins weakly. The last whorl has fine, close, unequal longitudinal striæ, rather sharp above, but weakening to irregular wrinkles below the periphery; these striæ are imperfectly cut into long grains by spiral impressed lines, which gradually weaken below the periphery, and almost wholly disappear near the base. Whorls $6\frac{1}{2}$ to $7\frac{1}{3}$, moderately convex, the last descending more rapidly. Suture pale-edged, a little irregular but not crenulated. The outer lip is straightened above; columella very concave.

Length 39, diam. 15, aperture 21.5 mm. San Antonio.

Length 51, diam. 18, aperture 26 mm. New Braunfels.

Texas: Austin; San Marcos; New Braunfels; Victoria Co.;

San Antonio, Bexar Co. (type loc.); near Hondo; canyon of the Pecos river, Val Verde Co. Also reported from Guadalupe, Goliad, Gonzales, Caldwell and Frio counties.

Glandina truncata de Kay, ROEMER, Texas, p. 456.—*G. decussata* W. G. BINNEY, Terr. Moll., v, p. 86; Man. Amer. Land Shells, p. 351, Texan localities, but not the description and figure.—*G. texasiana* Pfr., and *G. decussata*, W. G. BINN., Third Supplement to Terr. Moll., v, pp. 194, 226, pl. 9, f. a (teeth).—*G. singleyana* W. G. B., Fourth Supplement to Terr. Moll., v, Bull. Mus. Comp. Zool., xxii, no. 4, p. 163, pl. 1, f. 4, 1891 (Bexar Co.).—SINGLEY, Contrib. Nat. Hist. Texas, in Fourth Ann. Rep. Geol. Survey of Texas, 1893, p. 302.—*Euglandina singleyana* PILS. & FERR., Proc. A. N. S. Phila. 1906, p. 143.

This common species of the Texan Lower Sonoran area differs from other forms found in the United States by its distinct though fine spiral sculpture. It has far finer sculpture than *E. corneola* and a much more obtuse apex. *E. decussata*, a Guatemalan species, perhaps extending into southern Mexico, is conspicuously different by its peculiar columella. *E. texasiana* stands close to *singleyana*, but lacks spiral sculpture and is a smaller, more slender shell.

E. singleyana was first noticed by Dr. Ferdinand Roemer, who found it at New Braunfels in 1849. Binney subsequently referred Texan examples to his *G. corneola*, which he decided later to be a synonym of *G. decussata* Desh. This resulted in a curious complication in his later works, wherein the name belongs to one species (*decussata*), the figure and description to another (*corneola*), and the locality and anatomical details to a third (*singleyana*).

Figs. 48, 49 of plate 24 represent topotypes from San Antonio, Texas. Figs. 50, 51 are from a New Braunfels example.

31. *E. TEXASIANA* (Pfr.). Pl. 24, figs. 52, 53, 54.

Vol. I, p. 34. This species seems to be confined to northeastern Mexico and the extreme southern angle of Texas, some specimens before me being labeled Brownsville, Texas. A

small form from Valles, State of San Luis Potosi, is figured, pl. 24, figs. 52, 53, 54, length 24 mm. Similar examples were found at El Abra, near Valles. At Tampico the specimens are larger, length 28.5 to 29 mm., and of a handsome fleshy-brown color. This series was collected by Mr. A. A. Hinkley.

32. *E. ROSEA* (Férussac).

This species was first noticed scientifically by Thomas Say, who erroneously referred it to *Polyphemus glans* of Montfort. Specimens were sent by him to Férussac, who recognized it as distinct under the name *Helix rosea*, subsequently figuring it in the *Histoire*. These facts have been recognized by Beck (Index Moll., p. 78, 1837) and by Prof. von Martens (Biologia Centrali Americana, Mollusca, pp. 60, 78); but most other authors identified a roseate Mexican species, *E. cumingi* Beck, as Férussac's *H. rosea*.

Férussac erroneously quotes *Buccinum striatum* Chemnitz and *Bulla truncata* Gmel. as synonyms of his *H. rosea*, which led Say, in 1831, to adopt the name *Glandina truncata* for the Floridian species. I have elsewhere in these pages shown that *Bulla truncata* Gmelin, based solely upon Kammerer's description and figure, is identical with *Glandina subvaricosa* Albers, a South American species, hence the name is not available for our shell, which must be called *Euglandina rosea* (Fér.).

Southern U. S.: South Carolina to southeastern Texas, in the humid region.

Polyphemus glans SAY, Journ. Acad. N. S. Phila., i, p. 282, 1818, not of Montfort. — *Helix rosea* FÉRUSSAC, Prodrôme, Tabl. syst. des An. Moll., p. 50, no. 356 (1821). — *Glandina rosea* BECK, Index Moll., p. 78 (1837). — *Glandina truncata* SAY, Amer. Conch., ii, pl. xx. — STREBEL, Beitrag, ii, p. 5, pl. 1, f. 1, 3; pl. 3, f. 1, f. 2 (var. *parallela*), f. 3 (var. *bullata*). — BINNEY, Man. Amer. Land Shells, p. 348, with var. *minor*, p. 475. — DALL, Trans. Wagner Free Inst. of Sci., iii, pt. 1, p. 19 (1890), with vars. *macer* and *ovata*.

This species is excessively variable, the extreme forms being more unlike in size, shape, texture, color and form of the

columella than most acknowledged species of the genus. The sculpture, however, is much alike in all. The following varieties have been proposed:

E. rosea bullata (Gld.). Vol. I, p. 32. Var. *abbreviata* Marts. and var. *ovata* Dall seem to be intermediate between *bullata* and *rosea*.

E. rosea (Fér.). Vol. I, p. 32.

E. r. parallela W. G. B. Vol. I, p. 32.

E. r. minor W. G. B.

E. r. macer Dall. 75x20 mm. Florida.

33. *E. IMMÉMORATA* Pilsbry, n. sp. Pl. 24, figs. 46, 47.

The shell is rather slender and long, thin, corneous, the spire slender, rather straightly conic, apex obtuse. The apex is small; first $2\frac{1}{2}$ whorls convex, smooth; the later whorls sculptured with striæ which are thread-like on the spire, wrinkle-like on the last whorl, quite unequal in size, some of them enlarged at the suture, forming an irregular but rather strong denticulation. Below the suture there are some faint traces of spiral striæ in places. Whorls 7, moderately convex, the last more rapidly descending. Aperture small, vertical, bluish-white inside. The outer lip arches forward in the middle. Columella moderately concave, truncate as usual. Length 39, diam. 14.5, length of aperture 18 mm.

Texas, exact locality unknown.

This species is represented in the collection of the Academy by a specimen received from Mr. W. G. Binney under the name *G. texasiana*, and another in the A. D. Brown collection labeled *G. albersi*, both bearing the locality "Texas." It has some resemblance to *E. turris* Pfr., but differs by the irregular and coarser sculpture. It is quite unlike *E. texasiana* in sculpture and the shape of the spire, and I have been unable to refer it to any Mexican species.

34. *E. RHOADSI* (Pilsbry). Pl. 26, figs. 21, 22, 23, 24.

Shell long, rather slender, uniform chestnut-colored, very glossy, rather thin but strong. Spire long, with slightly convex outlines and obtuse apex. The embryonic shell consists

of $2\frac{3}{4}$ to 3 whorls, the last with some faint subsutural plication, the rest smooth and convex. The fourth whorl is plicate below the suture, the plicæ mostly rather short; on subsequent whorls they become larger, but hardly reach the suture below. On the last whorl there are 2 or 3 fine plicæ in 1 mm.; they reach about to the middle, or in places may be much shorter; they show some fine transverse crinkling near the suture, and are indistinctly cut by a few spiral depressions in some places. The lower half of the whorl is smoother, with low wrinkles of growth only. The suture is weakly or very weakly crenulated by the plicæ. The aperture is narrow, the columella straight or concave.

Length 54, diam. 19.5, aperture 29 mm.

Length 53.3, diam. 19, aperture 26 mm.; whorls $7\frac{2}{3}$.

Length 50.5, diam. 17, aperture 25 mm.; whorls $7\frac{1}{2}$.

Northeast Mexico: Diente, near Monterey, State of Nuevo Leon (S. N. Rhoads).

Glandina rhoadsi PILS., Proc. A. N. S. Phila. 1899, p. 395; 1903, p. 771, pl. 47, f. 3, 3 a, b.

In shape the specimens vary from fusiform to saccate. The fine plication is well developed only near the suture, and is nowhere conspicuously decussated.

35. *E. VICTORIANA* (Pilsbry). Pl. 26, figs. 18, 19, 20.

Shell cylindric-oblong, slender, rather thin, very glossy, fleshy-brown, marked with several white lines, indicating former peristomes, on the last whorl; the suture pale-bordered. Spire convexly long-conic, the apex rounded, obtuse. The first $2\frac{1}{2}$ to 3 whorls are smooth. The later whorls have a very even sculpture of smooth, rounded rib-striæ, $2\frac{1}{2}$ to 3 in 1 mm. on the last whorl, weak or subobsolete near the columella and base. There is some very faint crinkling of the intervals near the suture, which is only weakly crenulated by the striæ. The aperture is very long and narrow; outer lip white-edged; columella strongly concave.

Length 37, diam. 12, aperture 19.5 mm.; whorls 7.

Length 44, diam. 14.5, aperture 21.5 mm.; whorls $7\frac{1}{2}$.

Northeast Mexico: canyon four miles west of Victoria, State of Tamaulipas (Rhoads).

Glandina victoriana PILS., Proc. A. N. S. Phila. 1903, p. 771, pl. 47, f. 4, 4 a, b.

Distinguished by its narrow, elongate shape, smooth, regular and close riblets without spiral lines, and the occasional variceal white lines marking the positions of former peristomes. There are two of these lines on the back of the specimen figured, four on the last whorl of one 44 mm. long.

36. *E. DELICATA* (Pilsbry). Pl. 28, figs. 48, 49, 50.

Shell pale-corneous, thin and delicate; fusiform, tapering toward both ends. Surface closely rib-striate, the costulae about as wide as the intervals, quite smooth, and slightly weaker at the base. Spire tapering to a rather small apex, the first 3 whorls smooth, striae then gradually appearing. Suture a little crenulated by the striae in places, elsewhere somewhat irregular but not crenulate: having a narrow transparent-gray margin. Aperture more than half the shell's length, the outer lip thin, but slightly arched forward in the middle, receding at base. Columella short and nearly straight, abruptly truncate.

Length 23.7, diam. 9, length of aperture 14 mm.; whorls $6\frac{1}{2}$.

Northeast Mexico: canyon four miles west of Victoria, Tamaulipas (S. N. Rhoads). Types 85917 A. N. S. P.

A small, sharply striate species, with larger aperture than *E. delicatula*.

37. *E. ALTICOLA* (Pilsbry). Pl. 28, figs. 51, 52, 53.

Shell small and thin, cylindric-fusiform, fleshy-brown with pale summit. Spire conic with obtuse apex. The first whorl is somewhat raised, though the apex itself is depressed; first $2\frac{1}{2}$ whorls smooth, convex, then striae appear near the suture; after the third whorl the striae continue from suture to suture. The last whorl has strong, rather sharp, smooth rib-striae which weakly crenulate the suture and continue to the base. The last half-turn of the suture descends a little more than the preceding whorls. Aperture narrow; outer lip thin, projecting forward in the middle. Columella very short, concave.

Length 16, diam. 6, aperture 9.2 mm.; whorls $5\frac{3}{4}$.

Length 17, diam. 6.5, aperture 10.2 mm.; whorls 6.

Northeast Mexico: Diente, near Monterey, State of Nuevo Leon (S. N. Rhoads), type 77174 A. N. S. P.

Glandina delicata alticola Pils., Proc. A. N. S. Phila. 1903, p. 772, pl. 48, f. 2.

Smaller and more cylindric than *E. delicata*, but with embryonic whorls of the same size; sculpture sharper, aperture smaller, and the columella is more concave. The oblique descent of the last whorl and the equal size of a number of specimens taken show the form to be full grown.

38. *E. CUMINGI* (Beck). Syn., *Oleacina* or *Glandina rosea* of Pfr., Crosse et Fischer and other authors (not of Férussac), vol. I, p. 38. *G. alabastrina* Alb., vol. I, p. 33. *A. petiti* Desh., vol. I, p. 38. Prof. von Martens has shown that this handsome shell is not the *Helix rosea* of Férussac, that being the species commonly known as *G. truncata*.

39. *E. CARMINENSIS* (Morelet). Vol. I, p. 40.

40. *E. DAUDEBARTI* (Desh.). Vol. I, p. 41 (*G. audebardi auct.*).
Var. *AMOENA* Marts., vol. I, p. 39. Var. *MIRADORENSIS* Strebel, vol. I, p. 41.

Var. *JALAPANA* Martens (pl. 22, figs. 13, 14, 15). Shell larger than *E. longula*, tawny, the columella moderately arcuate. Length 55, diam. 19, length of aperture 26 mm. Misantla and Jalapa. "May be only a variety of *G. audebardi*, but it is distinctly more elongate, the sculpture is somewhat stronger and the color is more intense." Other specimens measure, length 42, diam. 19.5, aperture 26 mm.; and 54x20, ap. 25 mm.

41. *E. LIEBMANNI* (Pfr.). Vol. I, p. 37. *Achatina marminii* Desh. (vol. I, p. 33) may be a young specimen of this.

42. *E. COGNATA* (Strebel). Vol. I, p. 38.

43. *E. INSIGNIS* (Pfr.). Vol. I, p. 39.

44. *E. NYMPHA* (Crosse & Fischer). Vol. I, p. 38.

45. *E. LAMYI* (Fischer et Chatelet). Pl. 23, fig. 28.

Shell whitish, rather solid, with long, slightly convex, nearly conic spire. Whorls $9\frac{1}{2}$, the first three smooth and glossy, forming an obtuse apex; following whorls slightly convex, parted by a deep suture, sculptured with irregular plicæ of growth, which are fewer and stronger near the suture. Last whorl hardly descending, subcylindric. Aperture half the total length, contracted above, rounded beneath, the margins joined by a thin callus. Columella strongly intorted, deeply emarginate at the base. Length 82, diam. 29, aperture 41 mm. (*F. et C.*).

Mexico: near Cardenas, State of San Luis Potosi (Jandrier).

Glandina lamyi F. et C., Journ. de Conchyl., li, 1903, p. 321, pl. 13, f. 10; liv, 1907, p. 270.

This species may be compared with *E. liebmanni* Pfr., but that has a more obtuse apex, the plicæ form veritable teeth at the sutures, and the columella is decidedly less arcuate than in *E. lamyi*.

46. *E. LONGULA* (C. & F.). Vol. I, p. 39.47. *E. PINICOLA* (Fischer et Crosse). Vol. I, p. 37.48. *E. TURRIS* (Pfr.). Vol. I, p. 33. Mazatlan.49. *E. MAZATLANICA* Martens. Pl. 23, figs. 39, 40.

Shell subcylindric, rather solid, closely costulate-striate, corneous-brown. Whorls $6\frac{1}{2}$, a little convex, the apex obtuse; suture subangulate, lightly margined, scarcely crenulate. Aperture nearly half the total length, lanceolate, the outer margin arcuately produced; columella rather straight, abruptly truncate. Length 30 to 32, diam. 11.5 to 13, aperture 15 to 16 mm. long, 6 to 6.5 wide (*Marts.*).

Northwest Mexico: Mazatlan; Tres Marias Is. (Forrer).

Glandina mazatlanica MARTS., Biologia, p. 65, pl. 4, f. 2, 3 (1891).

"This species is somewhat intermediate between *G. pseudoturris* and *G. albersi*, the color and suture is as in the former,

but the form is less elongated." In the var. *abbreviata* Märs. (pl. 23, fig. 41) the spire is short, the penultimate whorl swollen. Length 30, diam. 12, aperture 15 mm. It is from the Tres Marias Is.

50. *E. PSEUDOTURRIS* (Strebel). Vol. I, p. 35. S.-W. Mexico.

51. *E. ANOMALA* (Angas). Vol. I, p. 33. Costa Rica.

52. *E. CANDIDA* (Shuttleworth). Pl. 28, figs. 55, 56, 57.

Shell fusiform-acuminate, rather thin, somewhat glossy, obsoletely and distantly plicatulate, white. Spire acuminate-conic, the apex obtuse. Whorls 6, slowly increasing, a little convex, the last as long as the spire. Suture margined, sub-crenulate; columella arcuate, abruptly truncate at the base. Aperture acuminate-semioval, the peristome simple, acute, straight. Length 24, diam. 9, aperture 11x5 mm. (*Shuttl.*).

Mexico (Sandoz); Oaxaca (Uhde, type loc. of *G. simplex*).

Glandina candida SHUTTLW., Diagn. u. Moll., no. 2, p. 22, in Bern Mittheil. 1852, p. 202.—*Glandina simplex* STREBEL, Beitr., ii, p. 35, pl. 10, f. 25 *a, b, c*.—VON MARTENS, Biol., p. 66, pl. 4, f. 5, 5*a*, 6.

According to Prof. von Martens, *E. candida* (fig. 57) is a bleached specimen of what was later named *simplex* (pl. 28, figs. 55, 56). Both were described from single examples, and no others are yet known.

53. *E. CONULARIS* (Pfeiffer). Pl. 24, fig. 55.

Shell oblong-conic, rather thin, smooth, glossy, brownish flesh-colored. Spire long-conic, the apex obtuse; suture margined with a white thread. Whorls 6, slightly convex, the last as long as the spire or a little shorter, base slightly tapering. Columella very slightly arcuate, abruptly truncate. Aperture subvertical, acuminate-oval; peristome simple, acute. Length 23, diam. 8.5, aperture 11x4.5 mm. (*Pfr.*).

Mexico: (Salle, type in Brit. Mus.).

Achatina (*Glandina*) *conularis* PFR., P. Z. S. 1855, p. 100; Monogr., iv, p. 635.—*Glandina c.*, VON MARTENS, Biologia, p. 66, pl. 4, f. 8.

"Rather near to *G. simplex*, but distinct by the nearly straight columella." Prof. von Martens' figure of the type is reproduced.

54. *E. EXCAVATA* (v. Martens). Pl. 23, figs. 42, 43.

Shell subcylindric, closely striatulate, the striæ lighter and more irregular on the last whorl, spiral sculpture scarcely visible under the lens, rather glossy. Whorls 6, the first obese, slightly convex, the penultimate and last nearly flat; apex obtuse; suture nearly simple, whitish or pale gray. Aperture piriform-lanceolate, scarcely half the length of the shell, the outer border nearly perpendicular, slightly arching forward; columella excavated-arcuate in the middle, laminiform below, spirally twisted and transversely truncate. Length 31, diam. 11.5, aperture 16x6 mm. (*Martens*).

Northwestern Mexico: Mazatlan (?).

Glandina albersi Pfr., W. G. BINNEY, Land- and Fresh-water Shells of N. A., i, p. 18, fig. 9 (not the description).—*Glandina excavata* MARTS., Biologia, p. 67, pl. 4, f. 9, 9a.

"I have three specimens before me—two from Prof. W. Dunker's collection marked *G. turris*, Mazatlan (fig. 9), and one from Mr. Pâtel's collection labeled *G. albersi*, Peru; the real habitat of *G. excavata* is therefore quite uncertain. Nevertheless, I do not like to omit this species, as it is very similar in its general form to *G. pseudoturris*, but quite distinct by the columella and also by color.

"The figure given by Binney represents *G. excavata* rather well, both in the general shape and in the peculiar conformation of the columella. It is said to have been drawn from an authentic specimen of *G. albersi* in Cuming's collection; but it does not agree with the original description by Pfeiffer, who says 'testa ovato oblonga' and 'columella substricta descendens,' or even with that of Binney, which is a translation of that given by Pfeiffer" (*Martens*).

55. *E. CYLINDRACEA* (Phillips). Vol. I, p. 41.

Glandina (Achatina) cylindracea PHILLIPS, Proc. Acad. N. S. Phila. 1846, p. 67, pl. 1, fig. 33 (issued between July 1st

and 15th, 1846).—*Achatina* (*Glandina*) *largillierti* PFR., *Symbolæ ad Hist. Hel.*, iii, p. 90 (1846).

This species, very common in Yucatan, was well described and illustrated by Phillips prior to July 15, 1846. Pfeiffer gave a less detailed description, without a figure, in the same year, the exact date unknown. Strebel and von Martens have reduced the following to synonyms: *G. yucatanensis* Pfr. (vol. I, p. 35), *G. carnea* Pfr. (vol. I, p. 41), and probably *G. strebeli* Angas (vol. I, p. 33).

56. E. PITTIERI (v. Martens). Pl. 28, fig. 54.

“Shell nearly cylindrical, with crowded, fine, vertical striæ, yellow; suture finely crenulated and distinctly margined by a spiral furrow below it; 7 whorls, the uppermost forming a very obtuse summit, the penultimate comparatively long, just above the aperture $\frac{5}{3}$ as long as the antepenultimate, last whorl comparatively shorter; aperture distinctly less than half the length of the whole shell; columellar margin well arcuated, very obliquely truncated. Long 40, diam. 14, apert. 17 mm. (*Martens*).

Costa Rica: between Mokri and Ukatschka, near Talamanea (Pittier, Sept. 1898, in *Mus. Berol.*).

Glandina pittieri MARTS., *Biologia*, p. 611, pl. 44, f. 5 (Jan. 1901).

57. E. ORIZABÆ (Pfr.). Vol. I, p. 26.

58. E. TURGIDA (Pfr.). Pl. 24, fig. 56.

Shell subfusiform-ovate, rather solid, lightly and closely striate, slightly glossy, isabelline. Spire conic, the apex obtuse; suture very lightly crenulated. Whorls 7, swollen, the upper ones smooth, the last slightly shorter than the spire, tapering basally. Columella straightened, abruptly truncate. Aperture vertical, sinuate-semioval, reddish inside; peristome simple, acute. Length 30, diam. 12, aperture 15x5.66 mm. (*Pfr.*).

Mexico: Juquila, State of Oaxaca (Boucard).

Oleacina turgida PFR., *P. Z. S.* 1861, p. 26; *Monogr.*, vi, p.

280.—*G. turgida* MARTENS, Biologia, p. 73, pl. 4, f. 16, with var. *sayulana*, f. 17-20a (1891).

"Resembles in its general form *G. largillierti*, but larger, broader, and wanting the distinctly marginate and crenulated suture. I am indebted to Mr. Edgar Smith for a figure of the type of this species" (v. *Marts.*).

58a. Var. SAYULANA Martens. Pl. 24, figs. 57, 58, 59.

Shell ovate-oblong, subcylindric, lightly striate, rather glossy, reddish-yellow. Spire long, somewhat obtuse. Whorls $6\frac{1}{2}$, convex, the penultimate rather large, suture nearly simple, violaceous. Aperture nearly half the total length or a little shorter, lanceolate, the outer margin lightly arched forward, columella moderately arcuate, white. Length 28-30, diam. 12, aperture 14-15 mm. (*Marts.*).

Sayula, State of Jalisco (Höge).

59. E. FILOSA (Pfr.). Vol. I, p. 34. Pl. 23, figs. 31, 32, 33.

Figured after v. Martens from a specimen in Pfeiffer's collection. Orizaba.

60. E. FISCHERI (v. Martens). Pl. 23, figs. 29, 30.

Shell fusiform-oblong, lightly plicate, brown, with nearly simple suture; spire obese above; columella arcuate. Length 37, diam. 15, aperture 18 mm. (*Marts.*).

Mexico: Toluca (Boucard, Höge).

Glandina filosa var. *b*, FISCHER et CROSSE, Miss. Sci. Mex., Moll., i, p. 129.—*G. fischeri* MARTS., Biologia, p. 74, pl. 5, f. 3, 3a.

"I have no doubt that the specimens collected by Herr Höge at Toluca are conspecific with Fischer and Crosse's var. *B.* of *G. filosa* from the same locality. Pfeiffer's *G. filosa* belongs to quite a different species. I have examined a specimen in his collection, and find that it has a distinctly more tapering spire, and the vertical ribs (to which it owes its name) distinctly more elevated. These specimens from Toluca are irregularly plaited near the suture, but the plaits or riblets very soon become quite faint and flat as they descend

downwards; the color is yellowish-brown, the columella very much arcuated. In the general form, sculpture, and color of the shell *G. fischeri* somewhat resembles large specimens of *Limnaea palustris*. It is intermediate in form between *G. filosa* and *G. pseudoturris*; but is distinct from both by the much more blunt apex (like that of *G. audebardi*), the somewhat coarser sculpture near the suture, and the arcuated columella" (*Martens*).

61. *E. SULCIFERA* (*Martens*). Pl. 23, figs. 34, 35, 36.

Shell ovate-oblong, short-spined, sculptured with rather wide perpendicular wrinkles parted by somewhat unequal impressed sulci; grayish flesh-colored, glossy. Suture irregularly crenulated, whitish-violaceous. Spire broadly conic, obtuse. Whorls 6, the first 3 smooth. Aperture ovate-lanceolate, slightly more than half the total length; columellar margin rather thick, very oblique, white, widely truncate. Length 32, diam. 13, aperture 17x7 mm. (*Marts.*).

Western Mexico: Jalisco (*Schumann*).

Glandina sulcifera MARTENS, *Biologia*, p. 74, pl. 5, f. 1.

62. *E. ALBERSI* (*Pfr.*). Vol. I, p. 34. Mazatlan, etc. Var. *inflata* *Martens*, *Biologia*, p. 75.

63. *E. MITRIFORMIS* (*Angas*). Vol. I, p. 35.

64. *E. NANA* (*Shuttl.*). Vol. I, p. 35.

65. *E. AMBIGUA* (*Pfr.*). Vol. I, p. 23.

66. *E. TORTILLANA* (*Pfr.*). Vol. I, p. 35.

67. *E. DIFFICILIS* (*C. et F.*). Vol. I, p. 34.

II. Section LÆVIGLANDINA Pilsbry, n. sect.

Smooth, ovate forms, with few whorls (5 to 7) and no varices. Chiefly characteristic of Central America. Type *E. underwoodi*.

68. *E. UNDERWOODI* (*Fulton*). Pl. 27, fig. 44.

"Shell ovate-conic, moderately thin, dark reddish-brown,

polished, almost smooth, growth-lines showing more distinctly at and below the suture, which is very narrowly but distinctly filleted; whorls $5\frac{1}{2}$, slightly convex; apex obtuse; aperture ovate, a little less than half the length of the shell; lip simple, scarcely thickened; columella incurved, truncate" (*Fulton*).

Length 21, diam. 11 mm. (*Fulton*).

Costa Rica: "Asaha Centago" (Azajar de Cartago), C. F. Underwood, Biolley.

Oleacina underwoodi FULT., Annals and Magazine of Nat. Hist., 6th Series, xx, p. 212, pl. 6, f. 9 (August, 1897).—*Glandina u.*, MARTS., Biologia, p. 612.

A handsome dark purple-brown shell, much shorter than *E. aurantiaca*. The narrow sutural border is defined by an impressed line, and at the suture itself a very narrow whitish line runs. Under a strong lens very weak traces of spiral lines are visible. The columella is more concave in a front than in an oblique view, and the outer lip is strongly arcuate. One of the type lot measures, length 20.5, diam. 10, aperture 9.5 mm.

69. *E. CHIRIQUIENSIS* (Da Costa). Pl. 27, fig. 45.

Shell subfusiform-oblong, pellucid-corneous or whitish; spire subobtuse, at the sutures impressed and marginate. Whorls 5, rounded, polished, longitudinally strongly striate, under a lens transversely striate. Columella twisted, abruptly truncate, whitish; aperture moderate, the lip white-edged. Length 19.5, diam. 9, aperture 9×4.5 mm. (*Da C.*).

Panama: Chiriqui.

Glandina chiriquiensis Da C., Proc. Malac. Soc. London, iv, p. 66, pl. 7, f. 2 (1900).—*G. chiriquiana* v. MARTS., Biologia, p. 612.

This species bears a strong resemblance to *G. underwoodi* Fulton, but differs from it in having a more attenuated spire. The color is generally much paler, in fact occasionally it is nearly white, while the columella and peristome are always white (*Da C.*).

70. *E. TRYONIANA* Pilsbry, n. sp. Pl. 27, figs. 46, 47.

The shell is ovate-conic, rather solid, olivaceous, with some faintly darker streaks. Spire conic, with hardly convex outlines and obtuse summit. The first two whorls are smooth, then fine vertical striae gradually begin; the last four whorls are sculptured with very fine, sharp, unequal striae with scratch-like intervals. There is no spiral sculpture. Whorls 7, moderately convex, the last well rounded. Suture well impressed, not crenulate, and appearing margined by transparence, in some lights, but without true margination. Aperture vertical, small, the outer lip forming a regular arch, very blunt, with a pale edge, a trifle arching forward in the middle. Columella short, concave, white. Length 27, diam. 12.5, longest axis of aperture 13 mm.

Central America (J. S. Phillips), exact locality unknown.

This species resembles *E. underwoodi* and *E. chiriquiensis* in shape, but differs from them in the fine, sharp sculpture. All of these species are distinguished by the regularly and strongly arcuate outer lip, giving an unusually open shape to the aperture.

71. *E. LANCEOLATA* (v. Martens). Pl. 27, figs. 38, 39, 40.

Shell fusiform-lanceolate, thin, irregularly striatulate, some striae more prominent, like varices, glossy, uniform yellow; spire regularly tapering, the apex rather obtuse. Whorls 7, the suture lightly plicatulate and margined, last whorl slowly tapering downwards, slightly more than half the total length, lanceolate; outer margin nearly straight, columellar margin deeply excavated, transversely truncate. Length 30, diam. 12, aperture 14.5x7 mm. (*Marts.*).

Southwestern Mexico: Omilteme, State of Guerrero (H. H. Smith).

Glandina lanceolata MARTS., Biologia, p. 69, pl. 4, f. 1, 1 a, b.

"Recognizable by the thin, glossy shell of yellow (not reddish or brownish) color, and the distinctly attenuated spire."

72. *E. ISABELLINA* (Pfr.). Vol. I, p. 31.

The locality "Mexico" requires confirmation. Specimens

apparently referable to this species are before me from Costa Rica (W. M. Gabb) and Bocas del Toro, Panama (Mr. Duff). Those taken by Gabb measure 25 to 28 mm. long, and vary from the shape of Reeve's figure of *isabellina* to a stouter form. Those from Bocas del Toro are small, 22x10 to 23x10.7 mm. I very much doubt whether *E. aurantiaca* Angas is distinct from *isabellina*.

73. *E. AURANTIACA* (Angas). Vol. I, p. 31. Costa Rica.

74. *E. DECIDUA* (Pfr.). Pl. 23, figs. 37, 38.

Shell fusiform, thin, striatulate, weakly decussated by spiral impressed lines visible under a lens, glossy, whitish, variegated with grayish-corneous cuticle deciduous in streaks. Spire conic, obtuse; suture slightly margined. Whorls 6, a little convex, the last about as long as the spire, tapering basally. Columella slightly arcuate, obliquely truncate. Aperture a little oblique, somewhat semioval; peristome simple, the right margin regularly arcuate. Length 28, diam. 11, aperture 14.5x5.5 mm. (*Pfr.*).

Mexico: Juquila, State of Oaxaca (Boucard).

Oleacina decidua PFR., P. Z. S. 1861, p. 26; Malak. Bl., viii, 1861, p. 79; Monogr., vi, p. 284. — *Glandina decidua* Pfr., MARTENS, Biologia, p. 70, pl. 4, f. 12, 13.

"The typical specimen described by Pfeiffer is not adult. I am indebted to Mr. Edgar Smith for the drawing of it (fig. 38) and of another, also contained in the British Museum, which is full-grown (fig. 37)" (*Martens*).

75. *E. OBTUSA* (Pfr.). Vol. I, p. 24.

Realejo and Polvon, Nicaragua. This species seems to connect the group of smooth Central American forms with the more normal Euglandinas.

III. Section VARICOGLANDINA Pilsbry, n. sect.

Shell having occasional impressed varix-lines and sometimes color stripes, as in *Varicella*, otherwise like *Euglandina*. Type *E. monilifera*.

This group stands between *Varicella* and *Euglandina* in characters of the shell, and some authors have referred the species to *Varicella*. The general shape and appearance of the shell however are Euglandinoid. Unfortunately no species has yet been dissected. The dentition and genitalia of *Varicella* and *Euglandina* are so entirely diverse that an examination of these organs would definitely settle the position of *Varicoglandina*.

The lip has a blunt, rounded edge (unless the specimen be taken during a growing stage), and the growth of the shell is evidently periodic, as in *Varicella*, while in *Euglandina* it seems to be more continuous during the activity of the animal, resting stages being usually ill-defined and irregular in occurrence.

Group of E. oblonga.

Small, very smooth and glossy, chestnut-brown forms, slightly plaited at the sutures but elsewhere with the gloss of a *Streptostyla*; having a few widely spaced varix-grooves. Except in color, this group has great resemblance to *Lævo-leacina*.

76. *E. OBLONGA* (Pfeiffer). Pl. 26, fig. 11.

Shell oblong, rather solid, smoothish, irregularly marked with impressed growth-striæ, glossy, pale tawny; spire gradually tapering, the apex obtuse, suture shallow, submargined. Whorls 7, scarcely convex, shortly plicatulate below the suture, the last whorl as long as the spire. Columella a little arcuate, obliquely truncate. Aperture subvertical, whitish inside, dilated in the middle, acuminate above. Peristome simple, unexpanded, the right margin arched forward in the middle, sinuated above. Length 15, diam. 5.66, aperture 8.5 x 3 mm. (*Pfr.*).

Mexico: Mirador, State of Vera Cruz (Dr. Berendt); Tehuacan, State of Puebla (Hoegel).

Oleacina oblonga PFR., Malak. Bl. xiii, 1866, p. 86; Monogr. vi, 273.—*Glandina oblonga* Pfr., MARTENS Biologia, Moll., p. 69, pl. 5, f. 6.

The figure, copied from von Martens, represents a shell from Tehuacan. The locality *Mirador* is doubted by von Martens.

76a. Var. POTOSIANA Pils., n. v. Pl. 26, fig. 14.

The shell is much larger than *E. oblonga*, composed of $7\frac{1}{4}$ whorls. The sutures have a whitish edge and appear very distinctly margined by transference of the wall; below them the whorl is weakly plicate. The surface is elsewhere extremely glossy and smooth except for occasional impressed, pale varix-grooves, of which there are 3 or 4 on the last whorl in adult shells. The color is rather light chestnut, somewhat transparent. Columella deeply concave above, short, abruptly truncate. Outer lip arching strongly forward in the middle.

Length 21.9, diam. 8, aperture 11.1 mm.; whorls $7\frac{1}{2}$.

Length 19.5, diam. 7.5, aperture 11 mm.; whorls $7\frac{1}{4}$.

Length 18, diam. 7, aperture 10.1 mm.; whorls $7\frac{1}{4}$.

N. E. Mexico: Valles, State of San Luis Potosi, type loc.; also Tampico (A. A. Hinkley).

This is a stouter shell than *E. dalli*, with fewer whorls and a more obtuse spire. It is larger than *E. oblonga*, with weaker subsutural plication.

76b. Var. TAMAULIPENSIS Pilsbry. Pl. 26, figs. 15, 16, 17.

Shell narrowly oblong, the last whorl somewhat cylindric, spire slowly tapering to a rather large, obtuse apex. Surface very glossy, smooth except for irregularly spaced, rather distinct and unequal, impressed lines in the direction of lines of growth; and the suture is bordered with fine, short and close folds. Whorls fully $7\frac{1}{2}$, regularly increasing, the last suture not more obliquely descending. Aperture about half the length of the shell, the outer lip arched forward in the middle, basal lip retracted; columella short, very concave above and convex below.

Length 15, diam. 5.7, length of aperture 7.5 mm.

Length 15, diam. 5.3, length of aperture 7.3 mm.

N. E. Mexico: in a cañon about 4 miles west of Victoria, State of Tamaulipas, elevation about 3,000 feet. Types No.

85,910, A. N. S. P. (S. N. Rhoads). A single specimen taken at Diente near Monterey, N. L.

Glandina oblonga tamaulipensis PILS., Proc. A. N. S. Phila. 1903, p. 772, pl. 47, f. 6.

This form, which was found in abundance, is evidently close to *G. oblonga* Pfr., but it is less plicate below the suture, the aperture is shorter and the columella is more curved. Fig. 17 represents a young shell.

77. E. MULTISPIRA (Pfr.). Vol. I, p. 30.

78. E. BELLULA (C. et F.). Vol. I, p. 23.

79. E. DALLI (Pilsbry). Pl. 26, figs. 12, 13.

Shell thin, slender, turreted and slowly tapering above, broadest near the base, which is rather "saccate." Brown, slightly translucent, smooth and glossy throughout, except for rather separated, very short impressed grooves below the sutures forming a series of very short, low folds there; and there are a few impressed, sinuous, longitudinal grooves each accompanied by a whitish streak reminiscent of former peristomes, on the last two whorls or more, two or three being on the last whorl. Spire long, with very slightly convex lateral outlines and quite obtuse apex. Whorls $8\frac{1}{2}$, slightly convex, the last one compressed laterally and decidedly full below. Aperture small, very narrow above, broad below, the outer lip pale-edged, thin, bent forward in the middle, strongly retracted below, giving the basal lip an effuse aspect. Columella short, strongly concave and conspicuously truncated below.

Length 20, diam. 6.5, length of aperture 10 mm.

Length 20.5, diam. 6.8, length of aperture 10 mm.

Length 18.8, diam. 6.8, length of aperture 10 mm.

Mexico: Diente, near Monterey, State of Nuevo Leon.

Glandina dalli PILS., Proc. A. N. S. Phila. 1899, p. 396; 1903, p. 772, pl. 47, f. 5, 5a.

Euglandina dalli belongs to a small group of Mexican species of small size and smooth, glossy surface, but seems abundantly distinct from any hitherto described. Compared

with *E. bellula* C. and F., this species differs in being of narrower form, with longer, narrower aperture, the posterior portion of which is more prolonged and much narrower; also in the comparatively simple suture. It is more lengthened than *E. oblonga* Pfr., and less plaited at the sutures. *E. ambigua* Pfr. is stouter in form; and *E. conularis* Pfr. has a wider aperture and far more arcuate outer lip.

80. *E. ATTENUATA* (Pfr.). Vol. I, p. 22. Central America.

Group of E. monilifera.

The surface is closely finely and evenly plaited, without spiral striæ; the impressed varix-lines are usually accompanied by a pale streak and preceded by a dark brown stripe. These forms were referred to *Varicella* by Crosse and Fischer.

81. *E. PULCHERRIMA* (Strebel). Pl. 27, figs. 35, 36, 37.

Shell strong, covered with a glossy cuticle, light ochre colored, with more or less intense brownish flesh-color, more or less deep brownish towards the apex. The peristome has a pale yellowish border, with a wider dark brown streak behind it, fading backwards into the ground color. There are two to four such growth-arrest streaks on the last two whorls. The sculpture on the second whorl is of pretty regular and closely arranged, very fine, arcuate riblets, which on the succeeding whorls increase, at first rapidly, then more slowly, and lose in sharpness. The shape of the embryonic whorls, the suture and columella are as in the *monilifera* group. Whorls rather convex, the last coiled more obliquely than the preceding, often more or less saccate below.

Length 33.8, diam. 16.2, aperture 17.8 x 8 mm.; whorls 6¼.

Length 28.5, diam. 13.4, aperture 14.8 x 6.6 mm.; whorls 6⅜.

Mexico: Quantatitlan and Ishuacan, State of Vera Cruz.

Glandina monilifera form B, STREBEL, Beitrag Mex. Land- und Süßwasser-Conch. ii, p. 49, pl. 13, f. 43, 43a.—*Glandina pulcherrima* STREBEL, Verhandlungen des Vereins für naturwissenschaftliche Unterhaltung zu Hamburg, v, 1883, p. 104.

Very like *E. monilifera* in color and form, yet it differs

by the sculpture of very fine, arcuate folds on the second whorl, and seems from what I have seen, to be distinct. Strebel notes that there were only three pale ochre colored examples in about 100 examined.

82. *E. DELICATULA* (Shuttleworth). Pl. 27, fig. 41.

Shell ovate-fusiform, thin, diaphanous, closely plicate-sulcate, very glossy; fleshy corneous, ornamented with narrow, widely separated, pale-edged reddish streaks. Spire elevated, conic, obtuse; whorls 8, convex, the last three-fifths the total length; suture impressed-marginate, crenulate; columella arcuate, the base abruptly truncate. Aperture semioval, somewhat dilated at the base; peristome acute, unexpanded, pale-edged. Length 17, diam. 8, aperture 8.5 x 4 mm. (*Shuttl.*).

Mexico: State of Vera Cruz, at Cordova, Jalapa and (*var. major*) at Coatepec.

Achatina delicatula SH., Diagn. n. Moll. no. 2, p. 22, in Bern. Mittheil. 1852, p. 202.—PFR., Monogr. iii, p. 514.—*Glandina delicatula* SH., MARTS., Biologia p. 70, pl. 5, f. 4, 5.

Var. major Martens, pl. 27, figs. 42, 43. Length 24, diam. 13.5 mm. Coatepec.

Very near *G. cordovana*, but more elongated. In Shuttleworth's collection (now in the museum at Berne) the label indicates positively Cordova as the locality; the specimen however is somewhat larger than the dimensions given in this author's description, which appears to have been made from an example in the Museum of Neufchatel. The former is figured here (fig. 4). A specimen collected by Herr Höge at Jalapa is very like it, but wants the brown varices. The example from Coatepec here noted as *var. a* (fig. 5) agrees with that in the Museum of Berne in most respects, especially in the sculptured varices, apex, and columella; but it is distinctly larger and its last whorl is comparatively shorter." (*v. Mart.*)

83. *E. CORDOVANA* (Pfr.). Vol. I, p. 26. In this species the striation extends to the base, and the lip projects in a little lobe above the middle.

84. *E. CONFERTA* (Pfr.). Vol. I, p. 34. Var. *crossei* Marts. Biol. p. 71.

85. *E. SPECIOSA* (Pfr.). Vol. I, p. 26.

86. *E. STIGMATICA* (Shuttl.). Vol. I, p. 28.

87. *E. MONILIFERA* (Pfeiffer). Pl. 27, figs. 26-29.

Vol. I, p. 26. In typical *E. monilifera* the rib-striæ disappear at the middle of the last whorl. The apex is more conic than in fig. 26 (which represents a blunt-topped form), but slightly less conic than fig. 30. The type measured, length 29, diam. 14.5, aperture 19 x 6.5 mm.; whorls 7. A large specimen received from Cuming, measures, length 32, diam. 14, aperture 18 mm.; whorls 7. Type locality is the Mountains of Coban, in northern Guatemala. The specimens figured on plate 27 show a small form with the spire more obtuse.

Var. *rubella* Morelet (pl. 27, figs. 33, 34; also figs. 30, 31, 32) has a longer spire, smaller aperture, rather stronger striation on the lower part of the last whorl, and more whorls in the same length than typical *monilifera*. Morelet's types measured, length 28-32, diam. 14, aperture 15.5-16.5 mm. Two specimens measure: length 34, diam. 15, aperture 17 mm., whorls 8. Length 31, diam. 13.2, aperture 16.3 mm., whorls 8. The specimen I described as *Glandina iheringi* (see pl. 27, f. 30-32) is apparently a younger state of *rubella*. Both are from the province of Vera Paz, Guatemala.

Glandina monilifera PFR., P. Z. S. 1845, p. 75.—MARTENS, Biologia p. 75.—*G. rubella* MORELET, Testac. Noviss. i, p. 14, 1849.—*Glandina iheringi* PILSBRY, Nautilus, May, 1900, p. 4.

I am indebted to Mr. E. R. Sykes for comparing specimens with the type of *E. monilifera* in the British Museum.

88. *E. SEMISULCATA* (Pfr.). Vol. I, p. 33.

Habitat unknown. It has somewhat the appearance of *E. monilifera*, and probably belongs either to this group or to the streaked South American group.

APPENDIX TO OLEACINIDÆ.

VARICELLA DENTICULATA SUTURALIS, n. subsp.

The shell resembles *V. d. charmettensis* (p. 116) except that the subsutural folds are more emphatic and more numerous, about 4 in one mm. on the last whorl. They are oblique and quite short, and visibly crenulate the upper edge of the whorl, which forms the lower edge of the narrowly channeled suture.

There are 4 curved linear variceal grooves on the last whorl, not well differentiated from some other shorter grooves. The outer lip is well arched forward, with a slight recess or notch at the lower third, producing an inconspicuous point, which does not, however, project beyond the general outline of the lip, as in other forms of the species, and is not thickened. Length 16, diam. 5, length of aperture 6.7 mm.; whorls 7.

Haiti: ruins of the palace Sans Souci, near Milot (C. T. Simpson and J. B. Henderson, Jr.).

I have figured the soft anatomy of the type specimen on pl. 34, figs. 6, 7, and pl. 39, fig. 24.

A broken shell from Sans Souci, referred to on p. 117, belongs to this subspecies.

STREPTOSTYLA SUMICHRASTI Ancey, (p. 151) has been re-described as "*Streptostyla sumichrasti* Crosse et Fischer MSS." by Mr. Ph. Dautzenberg, Journ. de Conchyl. lv, no. 4, p. 327, pl. 6, figs. 2, 3 (March 30, 1908). I have copied one of Dautzenberg's figures on my pl. 52, fig. 8.

Family FERUSSACIDÆ, Bourguignat.

Ferussacidæ BOURG., Histoire Malacologique de l'Abyssinie, 1883, p. 120; Prodrôme de la Malacologie terr. et fluv. de la Tunisie, 1887, p. 114.—*Cionellida* PFR. et CLESSIN, Nomenclator Heliceorum Viventium, 1881, p. 329.—*Cochlicopidæ* of some authors, PILSBRY, Proc. A. N. S. Phila. 1906, p. 148.—*Cæcilianellidæ* BOURGUIGNAT, Prodr. Malac. Tunisie, 1887, p. 127 (for the genus *Cæcilianella* Bgt.).

The shell is small or minute, imperforate, elongate, varying from ovate to turritate or subcylindric, thin, glossy, having little or no sculpture, and generally it is somewhat transparent.

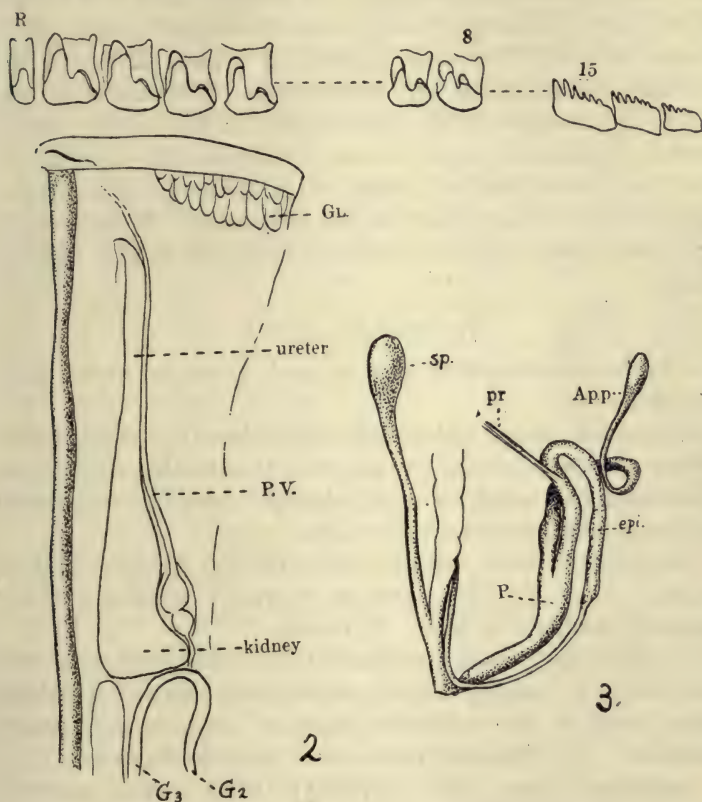
The apex is small and obtuse, embryonic whorls not differentiated from those following. Aperture ovate or piriform, simple or dentate. The columella is usually sinuate or truncate at the base. Outer lip not expanded, often thickened within.

The family *Ferussaciæ* is here retained simply as a temporary arrangement, pending more exact knowledge of the several genera. The pallial organs of only one genus, *Cochlicopa*, have been examined, and the other organs differ so widely in the two chief genera which have been dissected (*Cochlicopa* and *Ferussacia*), that one can scarcely believe them to be members of one family. The detailed descriptions of the soft anatomy may be found under the generic heads, but the facts are briefly as follows:

(1) In *Ferussacia gronoviana* according to Godwin-Austen, the head is proboscidiiform (pl. 42, fig. 77). The foot has pedal grooves and a caudal mucus pore (pl. 42, figs. 72, 76). The genitalia are simple, the penis being figured with terminal retractor and vas deferens and no appendix (pl. 42, fig. 75). The teeth are all tricuspid (pl. 42, fig. 78), and are very numerous, 60 to over 100 in a transverse row. The pallial organs are unknown. If the ureter is of the reflexed type, these characters indicate a distinct family of *Aulacopoda* related to the *Zonitidæ* and *Endodontidæ*. The genus *Cryptazeca* is closely related, having a similar foot and teeth. Various Madeiran *Ferussaciæ* examined by R. B. Watson are similar in external anatomy, jaw and teeth.

(2) In *Cochlicopa lubrica*, dissected by Lehmann and by myself, the foot has no pedal grooves or caudal pore. The penis has a long appendix (fig. 3 App.). The lateral teeth are bicuspid, having no entocones (fig. 1), and the marginals are low, wide and multicuspid. There are comparatively few teeth, 40 to 50 in a transverse row. The ureter passes directly forward from the kidney (fig. 2). *Azeca menkeana alzenensis* is known to agree with *Cochlicopa* in genitalia and teeth; and according to Lehmann, *Cæcilioides acicula* has genitalia of the same type. These characters are those of the terrestrial *Achatinellidæ*. So far as the groups

are now known, no character of importance separates *Cochlicopa* from *Leptachatina*.



Teeth, pallial tract and genitalia of *Cochlicopa lubrica*.

I would not hesitate to include *Cochlicopa*, *Azeca* and *Cacilioides* in *Achatinellidæ* were it not that some place must be found for *Coilostele*, *Calaxis*, *Glessula* and other genera, which I would not willingly venture to distribute between several families, without some knowledge of their soft anatomy. For the purposes of this work it may be better to group all of these little-known genera under the family head of *Ferussacidæ*, rather than to attempt a rearrangement for which adequate data are not now obtainable.

The *Ferussacidæ* are characteristic snails of the European fauna. The leading genera—*Cochlicopa*, *Azeca*, *Coilostele*—had already been differentiated in Eocene time, and apparently have undergone only minor changes since then. *Ferussacia* and *Cæcilioides* appear in typical forms in the Miocene, but doubtless are much older. The family *Ferussacidæ* is therefore to be classed with the *Clausiliidæ*, *Megaspiridæ*, *Oleacinidæ*, and various Cyclostomacea,—groups already well developed in Europe in the Mesozoic, and continuing on into Tertiary time, in the same area. References to the fossil species may be found under the several generic heads.

Synopsis of genera.

1. Genera with pedal grooves and a caudal pore, teeth tricuspid.

FERUSSACIA Risso. Shell cylindric-oblong to acutely ovate, rather solid, aperture more than half the shell's length, outer lip sinuous or arched forward, columella usually not truncate at base. Mediterranean region, etc.

CRYPTAZECA Folin. Shell ovoid, thin, the aperture half its length; outer lip thin, arched forward; columella short, abruptly truncate at base. Pyrenees.

CALAXIS Bgt. Shell lanceolate, thin, glassy; aperture very narrow above, usually with a parietal lamella and a palatal plica; base of the columella lamellar, projecting, strongly truncate. Soft anatomy unknown. Syria to Egypt.

DIGONIAXIS Jouss. Shell turrite, of 10-11 whorls; aperture small, semioval; outer lip simple, columella strongly bilamellate. Internal axis spirally lamellate. Aden, Ceylon.

2. Genera without pedal grooves or a caudal pore, and having an appendix on the penis and a direct ureter, so far as known.

AZECA Leach. Elliptical-ovate or oblong, rather solid, with the aperture more or less obstructed with teeth, outer edge of the parietal callus thickened, cord-like; columella usually strongly truncate at base. Eur-Africa.

COCHLICOPA Fér. Cylindric-oblong, with rather convex

whorls and small ovate toothless aperture; outer lip not arched or sinuous, thickened within; parietal callus thin; columella slightly sinuous, not truncate. Europe, Asia, North America.

HOHENWARTIANA Bgt. Small, slender, fusiform, fragile and clear corneous, with very slightly convex whorls; aperture piriform, toothless; outer lip thin; columella tapering or a little excised below, not truncate. Soft anatomy unknown. Europe.

CÆCILIOIDES Herrm. Very small and slender, with narrow spire and obtuse apex, thin, fragile and corneous; aperture ovate or lanceolate; outer lip thin, arcuate, columella usually truncate or subtruncate at base. (See Vol. XX).

COILOSTELE Bens. Minute, cylindric-turrite, apex obtuse, corneous, thin, the internal partitions absorbed in adults. Aperture small, ovate, oblique, toothless; columella not truncate. Aden, Spain, Mexico.

GLESSULA Martens. Ovate-conic with more or less turrite spire and convex whorls; aperture ovate, toothless; columella short, very concave, and strongly truncate at the base; outer lip thin. Size usually larger than any of the preceding. Oriental region. (See Vol. XX).

Genus FERUSSACIA Risso.

Ferrussacia RISSO, Hist. Nat. Eur. Mérid. iv, 1826, p. 80. Not *Ferussacia* Leufroy, Ann. Sci. Nat. xv, 1828, p. 403 (= *Ferussina* Grat. 1827, = *Strophostoma* Desh. 1828).—*Ferussacia* BOURGUIGNAT, Aménités Malacologiques, in Revue et Mag. de Zoologie 1856, p. 327.

Shell rather small (usually 6-12 mm. long), varying from acutely ovate to cylindric-oblong; usually somewhat opaque, glossy, composed of 5 to 8 flat whorls parted by a linear, superficial suture, usually bordered by transparency below. The aperture is ovate or piriform, more than half the length of the shell; the outer lip obtuse; columella having a convex fold, or rarely truncate at the base. Foot having pedal grooves and a caudal mucus gland, behind which the tail is truncate. Teeth all tricuspid, the centrals very small. Jaw finely plaited, genitalia simple.

Type *F. gronoviana*. Distribution, around the Mediterranean in Europe and North Africa; Atlantic Islands.

Lieut.-Col. H. H. Godwin-Austen describes the soft anatomy of *F. gronoviana* as follows:

"The animal (pl. 42, figs. 76, 77) is of a fine bright sea green colour: the eye-tentacles are dark and thick at their bases, which are contiguous; the oral very short and blunt; muzzle retractile, and can be produced considerably. It is of darker tint at the extremity of the foot, which has a distinct mucous gland with a truncate lobe above it. There is a well marked pedal line parallel to the edge of the foot, from which a series of regular transverse furrows extends to the dorsal side; but the intervals between these furrows are smooth, not papillate: this is seen to extend to the muzzle; but from the oral tentacles the whole upper part of the neck is strongly and longitudinally grooved. The animal when fully extended is long and narrow, end of foot equal with apex of shell when moving; and the mantle is all round slightly reflected over the thin margin of the peristome. The right dorsal lobe is small, the left is larger.

"The odontophore (pl. 42, fig. 78) consists of over a hundred rows of teeth, about 60 in each row, with a very considerable difference in the size of the centrals and laterals, the centre being very small, bluntly tricuspid, on an elongate oblate base; the next seven having a long pointed central tooth with the two smaller on either side; the outer laterals are minutely evenly tricuspid on broad, oblong rectangular bases. The dental formula is 22, 7, 1, 7, 22. The jaw (pl. 42, figs. 73, 74) is peculiar, not hard and chitinous as is usually the case, but thin and elastic, consisting of a thin membranous ribbon, closely ribbed or rather folded longitudinally, and presenting on the anterior side a zigzag or serrated edge. This elastic plicate structure of the jaw is thus quite in accord and adapted most admirably to the retractile muzzle of the animal. The buccal mass is well developed, of rounded form; the salivary ducts short, the glands of unequal size.

"*Generative organs*, (pl. 42, fig. 75). The penis (fig. 75, p) is short, fusiform, conical near the junction of the

vas deferens; the retractor muscle is given off close to this. The spermatheca is elongately pear-shape. No dart-sac was observed in the three specimens examined. The ovotestis in one specimen appeared to be a mass of globosely pear-shaped follicles united at their basal ends into a duct; but in two specimens there was found near the apex, embedded in the livers, a dark triangular-shaped organ, which, when examined more closely, was trilobed, uniting in a single duct, streaked and coloured black along its straight terminal margin, and may possibly have consisted of closely packed bundles of spermatozoa. The hermaphrodite duct was not made out, nor the albumen gland; and I most unaccountably did not notice the exact position, with respect to the right eye-tentacle, of the generative aperture." (*G-Aust.*)

The soft parts of *F. folliculus* from Madeira, examined by Watson (P. Z. S. 1877, p. 333, 334) resemble those of the other large Madeiran species, but the mantle was apparently somewhat less broadly reflexed over the shell. In external color it is quite unlike *F. gronoviana*—"yellow, towards the tail slightly orange, towards the head with a faint tinge of gray, which is darker towards the ends of the tentacles. The sole of the foot is lemon-colored."

In the Madeiran species *melampoides*, *tornatellina*, *triticea* and *oryza* "the mantle extends beyond the edge of the aperture all round. It is thinly spread over the outside of the shell, and extends like a tongue backwards behind the posterior corner of the aperture. The tail carries a mucous gland and is abruptly truncate" (pl. 42, fig. 72, *F. tornatellina*, after Watson). The jaw has about 60 slightly converging ridges. The teeth resemble those of *F. gronoviana*.

The following fossil forms of the *folliculus* group have been described:

Ferussacia convoluta Paladilhe, Revue des Sci. Nat., Montpellier, ii, 1873, p. 46, pl. 2, f. 7-9. Pliocene, Montpellier.

Ferussacia obovata Paladilhe, t. c. pl. 2, f. 10-12. Pliocene, Montpellier.

Ferussacia (Folliculus) polloneræ Sacco, 1885, and *F. (F.) tassaroiana* Sacco, 1888, are Pliocene species of the Villa-

franchian stage, belonging to the *folliculus* group. See Sacco, I Moll. terreni Terziarii del Piemonte etc., pl. 22, p. 75, pl. 6.

Ferussacia insignis Babor, Sitzungsber. k. boehm. Ges. der Wissensch. 1897, II, Art. 63, p. 8, fig. 3, Miocene, Tuchoritz, is apparently a precursor of the *folliculus* group.

Subgenera and Sections of Ferussacia.

Subgenus FERUSSACIA.

Section *Ferussacia* s. str., Mediterranean region.

Species 1 to 15.

Mauritian species, no. 16.

Canary Is. species, no. 17 to 21.

Section *Pegea* Risso. Northern Africa, 1 in Italy.

Species 22 to 62.

Subgenus AMPHORLLA Lowe. Madeira. Species 63 to 71.

Sections *Fusillus* and *Hypselia*.

Subgenus PYRGELLA Lowe. Madeira. Species 72.

Subgenus CYLICHNIDIA Lowe. Madeira. Species 73, 74.

Section *Ferussacia* Risso, s. str.

Ferussacia RISSO, Hist. Nat. Eur. Merid. iv, p. 80, for *F. gronoviana* (figured) and *F. sayea* (undeterminable).—*Vediantius* RISSO, Hist., p. 81, for *V. eristalius* Risso (young of *F. gronoviana*).—*Pseudostreptostyla* NEVILL, P. Z. S. 1880, p. 665, for *F. abnormis* Nevill (young of *F. vescoi*?)—*Folliculiana* BGT., Rev. et Mag. de Zool. 1864, p. 201.—*Folliculina* BGT., WESTERLUND, Fauna der in der Paläarktischen Region lebenden Binnenconchylien, iii, p. 154 (1887).—" *Folliculus* Ag.," WESTERLUND, l. c., not of Agassiz.

Shell oblong or cylindric oblong with convexly conic spire; aperture piriform, without a parietal lamella, the columella with a single convex subvertical fold, not distinctly truncate at base; outer lip thickened within, slightly retracted above and below.

This group consists of a large number of very closely related species or races and many local forms, spread over both coasts of the Mediterranean from Greece to Portugal and Morocco, but most numerous in northern Africa, Tunis to

Morocco. The most widely distributed forms are *F. folliculus* and the very closely allied *F. vescoi*. Bourguignat is the chief authority on this group; and the well-known tendency of that author to make species out of slight local races, or even from *extreme forms selected from a continuous series*, has not greatly helped an intricate subject. It is evident that the distinction between races and "species" is more or less arbitrary, and a great many forms of various degrees of differentiation exist. The sporadic distribution assigned to some of the nominal species probably indicates that they are recurring variations of wide-spread forms rather than independent stocks. Morelet (Journ. de Conchyl. 1877, p. 248) believes that *F. folliculus* and *vescoi* intergrade in characters, and are not specifically separable. Wollaston has expressed the same view; and with many specimens of half a dozen of the nominal species before me, I find the alleged distinctions illusive and difficult to apply in actual practice. Whether the *folliculus* group consists of one or a dozen "species" must be left an open question.

The groups *Folliculiana* and *Folliculina* have *F. folliculus* as their type species.

F. aphelina Bourguignat. "A Sicilian species having the spire very long, analogous to *F. vitrea* of the island of Tenerife." (*Ferussacia aphelina* BGT., Revue et Mag. de Zool. xvi, 1864, p. 207; Malac. de l'Algerie p. 29.). No further information has been published. It may possibly be what Benoit described as *Achatina nebrodensis*.

1. *F. FOLLICULUS* (Gronovius). Pl. 41, figs. 53, 54.

"Shell cylindric-elongate, smooth, glossy, subpellucid, corneous-buff; spire rather elongate conic, the apex rather obtuse or a little acute. Whorls 6, slightly convex, irregularly increasing, suture paler corneous margined; three first whorls regularly increasing, the fourth a little larger, antepenultimate whorl large, a little more rapidly descending; last whorl not half the total length. Aperture lunate-oblong; peristome acute, simple; columella short, straight; outer margin excised at the suture, then forwardly dilated; margins joined by a

whitish callus. Length 9, diam. 3, aperture 3 mm." (*Bourguignat*).

Mediterranean countries, Portugal and Spain to Greece, Sicily, Malta, Tunis, Morocco, Canary Islands and Madeira. Type locality Northern Africa.

Bulla or *Helix folliculum* GRONOVIVS, Zoophylacium Gronovianum, pt. iii, 1781, tabularum explicatio p. v; pl. 19, figs. 15, 16.—*Helix folliculus* GMEL., Syst. Nat. (13), p. 3654.—*Achatina folliculus* of authors, see PFEIFFER, Monographia Heliceorum Viventium ii, 283; iii, 511; iv, 636 (as *Oleacina*), vi, 247, viii, 301; Küster's Conchyl. Cab. pl. 18, f. 16-19.—*Ferussacia* f., BGT. Amén. Malac. i, p. 197; Malac. terr. chateau d'If, p. 22, pl. 2, f. 1-3; Prodr. Malac. Tunisie p. 117.—WESTERLUND, *Fauna*, iii. p. 154.—*Lovea* f., WOLLASTON, Testacea Atlant. p. 247.—*Physa scaturigium* DRAP., Hist. Nat. Moll. de la France, p. 56, pl. 3, f. 14, 15 (immature stage).—*Pupa splendidula* COSTA, teste Scacchi, Catalogus Conchyliorum regni Neapolitani, 1836, p. 17 (nude name).—*Turbotisius* Chiereghini, BRUSINA, Ipsa Chiereghinii Conchyli, 1870, p. 214, name only.—*Achatina risso* DESHAYES, Encycl. Meth. vers, ii, p. 12, 1830 (Nice).—*Lovea wollastoni* WATSON, P. Z. S. 1877, p. 334 (Madeira; description of external anatomy and coloration).

Bourguignat, whose description is given above, at first thought this species restricted to southern France and Spain, but later reported it from Tunis. Gronovius figures *F. folliculus* very rudely. He describes it as "oblong-ovate, pellucid, glabrous; columella subplicate; outer lip thin; size of a grain of oats. Habitat on the coast of Barbary." Which of the several scarcely distinguishable races was before him it is at present impossible to determine; but in the narrow sense *F. folliculus* may as well be restricted to the form defined by Bourguignat. Specimens from Toulon, France, are figured, pl. 41, figs. 53, 54.

I have also illustrated a Madeiran example, pl. 39, figs. 15, 16. It occurs in numerous places not far from Funchal, "chiefly beneath stones in hot and rocky situations near the coast, among plants of the *Opuntia tuna* or prickly pear."

The Madeiran form has been called *Lovea wollastoni* by Watson, but no characters separating it from European *folliculus* have been indicated, though it may prove that the coloration of the soft parts is different. Wollaston thinks that it may have been imported from Portugal.

Numerous varieties have been described; what their value is I cannot say, but all published information is here given.

Var. *denarensis* De Gregorio. Corneous yellow, similar to *F. biondiana* Ben., but a little larger, the aperture less produced forward, a border along the suture, and the columellar lip is thickened. It differs from *vescoi* by the less regularly conic spire, want of a columellar fold, and the presence of a sutural border. Scorecia Denaro, near Palermo, at the little bridge of the Pagliarelli. (*Ferrussacia folliculus* Gmelin var. *denarensis* De GREG., Il Naturalista Siciliano xiv, 1895, p. 207).

Var. *abbreviata* Lowe. "Length 9, diam. $3\frac{1}{2}$, aperture 4 mm. long. Near Mogador, at the Emperor's Garden, up the river. Agrees with Portuguese better than Madeiran specimens in the more prominent columella" (Lowe). Probably identical with *vescoi*.

Var. *producta* Lowe. Length 10, diam. $3\frac{1}{2}$, aperture 4 mm. long. Differs from *abbreviata* only in the spire being longer in proportion to the aperture, and in the less prominent or developed columella. In this latter point it agrees with Madeiran better than with Portuguese examples" (Lowe). Rabat, Morocco, a single specimen, Mrs. Elton. (*Achatina folliculus* var. *a*, *abbreviata*, and var. *b*. *producta* LOWE, Journal of the Proc. of the Linnean Society, Zool. v, 1861, p. 203.)

Var. *pulchella* Moquin-Tandon. "Shell smaller, narrower, the aperture comparatively larger. Cette, Nimes and Marseilles (*Moq.*, Hist. Nat. Moll. de France ii, 1855, p. 307, pl. 22, f. 30).

Var. *amauronia* Bourguignat. (Pl. 41, figs. 57, 58). Cylindric-oblong, ventricose, glossy, subpellucid, smooth, corneous-buff; spire obese, the apex obtuse; whorls $5\frac{1}{2}$, a little convex, regularly increasing. separated by a paler margined

suture, the last whorl rounded, not half the total alt. Aperture lunate-oblong; peristome unexpanded, acute, a little thickened within; columella straight, callous within; outer margin strongly arched forward, the margins joined by a thin callus. Length 6, diam. 3.5, alt. apert. 3.5 mm. (*Ferussacia amauromia* BGT., Malac. chat. d'If, pl. 2, f. 14-16, Jan. 1860; Malac. de l'Algerie i, p. 37, pl. 3, f. 10-12).

Algeria; Portugal at Algarves (Bgt.). Differs from *F. regularis* by the more obese shell, summit more obtuse, whorls of the spire less closely coiled, and the outer lip is more strongly arcuate, within a little recession at the insertion. It is also more obtuse and ventricose than typical *F. folliculus*, with less numerous whorls, which increase *very regularly*, etc.

Var. *REGULARIS* Bourguignat. (Pl. 41, fig. 56). Whorls 7, regularly increasing, the last less than half the total length. Columella straight, short, with a slightly twisted lamella below. Length 10, diam. 3, aperture 3.75 mm. Type locality around Valletta, Malta; also occurs around Portici, near Naples (Bgt.), and in the drift of the Oued Sidi-Aich, Tunis (Letourneux et Bgt.).

Ferussacia regularis BGT., Malac. terrest. de l'île du Chateau d'If, pres de Marseille, p. 20, pl. 2, f. 7-9 (Jan. 1860); Revue et Mag. de Zool. xvi, 1864, p. 204; Prodr. Malac. Tunisie p. 117.—PFR., Monogr. vi, 248.

2. *F. RURICOLA* (Lowe). Pl. 42, figs. 68, 69.

Shell rather large, rather strong, subpellucid, turrite, subcylindric, long and somewhat slender, the spire produced, rather obtuse. Whorls 6, flattened, parted by an oblique, little impressed, margined suture. Aperture ovate, acute above but not acuminate, close to but scarcely over one-third the length. Columella arcuate, subdilated, slightly prominent and obscurely obliquely truncate at base, the peristome simple. Length 8, diam. 2.5, aperture 2.75 mm. (Lowe.)

Morocco: near Mogador (Lowe).

Achatina ruricola LOWE, Journ. of the Proceedings of the Linnean Soc., Zool. v, 1861, p. 203.—*Ferussacia ruricola* PALLARY, Journ. de Conchyl. 1898, p. 124, pl. 9, f. 3.

“Partaking chiefly of the characters of *A. maderensis* and *A. producta* Lowe, this elegant little species of which I found a single example at the picturesque spot already so often mentioned, called the Emperor’s Garden, about four miles from Mogador up the river, is perfectly distinct from each; and it will not even enter into either of the groups to which they respectively belong, appertaining properly to that of *Achatina folliculus* (Gron). In shape both of the shell and of its aperture it most resembles *A. maderensis* Lowe; but it wants the peculiar bright polish; it is twice as large; the spire is much less blunt, with flatter volutions and a shallower, more oblique suture; the pillar-lip is more dilated and prominent at the base; and lastly, the peristome is not obtuse or thickened and colored. From all the other allied Madeiran species it differs in its cylindric shape and short ovate aperture, simply acute, and not narrowed or acuminate at top. It is also a considerably larger shell than *A. gracilis* and *A. leacociana*, Lowe, to which, amongst these other species, after *A. producta*, Lowe, it most approaches; and from *A. producta*, Lowe, with which in shape and size it best agrees, it is abundantly distinct by the form and proportionate size of the aperture, besides the much less prominence of the pillar at its base. From *A. folliculus* (Gron.) it differs in the narrow turreted-cylindric shape, the short ovate aperture, and the perfectly even and regular volutions (without any turgidness in the penultimate volution) of the spire.” (*Lowe.*)

Pallary’s figures of topotypes are copied.

3. F. CASTROIANA Locard.

Shell of an almost regularly cylindric-elongate shape, tapering only at the two ends; spire short, the summit large and obtuse, composed of 5 or 6 feebly convex whorls, the first 4 increasing slowly and regularly, the last very large, quite cylindric above and throughout its length, not tapering except towards the base. Suture well marked, nearly horizontal in the upper whorls, a little oblique from the beginning of the last whorl above the angle of the aperture. Aperture excised, long and narrow, contracted and angular above, a little

narrowly rounded at the base. Peristome straight, acute, a little thickened within; columella short, callous; the outer margin nearly straight; margins joined by an indistinct callosus. The shell is very glossy, smooth, transparent, of an almost uniform yellowish-corneous tint. Length 9.5, diam. 3 mm. (*Loc.*).

Portugal.

Ferussacia castroiana LOCARD, Conchyl. Portugaise, Coq. terrest. etc., in Archives du Mus. d'Hist. Nat. de Lyon, vii, 1899, p. 139.

Distinguished chiefly by its regularly cylindric shape, tapering abruptly at the two ends. The increase of the whorls is very slow and very regular to the last whorl, where it is very rapid. The aperture is four-ninths the total length.

4. *F. AMBLYA* Bourguignat. Pl. 41, figs. 59, 60.

This *Ferussacia* is distinguished from *amauronia* and *forbesi* by its short, swollen form, regular and rapid convolution of the whorls of the spire, larger aperture, the columella more calloused and shorter. Length 8.5, diam. 4, aperture 4 mm. (*Bgt.*).

Around Algiers and other localities in Algeria.

Ferussacia amblya BGT., Malac. chat. d'If, pl. 2, f. 17-19 (1860); Malac. de l'Algerie i, p. 40, pl. 3, f. 13-15.

The specimen before me looks like a short form of *F. folliculus*. The following species is evidently quite similar.

5. *F. GRAVIDA* Florence.

Shell oblong, relatively short, ventricose, the greatest thickness at the upper part of the last whorl, slightly tapering downwards, fragile, diaphanous, very glossy, uniform pale corneous, very smooth. Spire moderately produced, obtuse, shortly tapering above and somewhat rotund, the apex obtuse. Whorls $5\frac{1}{2}$, irregularly increasing, the first minute, next relatively large, the third minute, fourth suddenly swollen and ample, the last whorl very ample and swollen above. Suture linear. Last whorl half the total length, regularly descending in front. Aperture vertical, irregularly

lunate-oblong; columella short, straight, twisted-lamellate within. Peristome unexpanded, acute, slightly thickened, the outer margin regularly arching forward, margins joined by a callus. Length 8, diam. 4, alt. of aperture 4 mm. (*Florence*).

France: Lauzade near Luc (Var), very rare under stones (*Florence*).

Ferussacia gravigida FLOR., Bull. Soc. Malac. France, iii, 1886, p. 230.

6. *F. VIRGINEA* (Westerlund).

Agrees most with *C. gravigida* Flor., but it has a much less obese shape, the upper whorls increase regularly, the suture is broadly margined, etc. Length 7, diam. 3 mm.

Spain: near Seville (Prof. Calderon).

Cionella (*Ferussacia*) *virginia* WESTERL., Nachrbl. d. Malak. Ges. xxiv, p. 195 (Dec. 1892); Anales de la Sociedad Espanola de Historia Natural, ser. 2, i, 1892, p. 388.

7. *F. GRONOVIANA* RISSO. Pl. 41, figs. 51, 52.

Shell cylindric, oblong, a little obese, more swollen on the left than on the right side, giving it a slightly *Streptaxis*-like appearance; glossy, a little transparent, of a yellowish-corneous tint, sometimes a little reddish. Spire tapering to the obtuse summit. Whorls 6, irregularly increasing, separated by a suture bordered with a paler margin. The first three whorls are small and increase evenly; the fourth is proportionally larger, especially convex on the left side; antepenult. whorl very large; last whorl descends less rapidly, and is less than half the total length. Aperture oblong, the peristome simple and acute; columella a little curved, short, somewhat lamella-like; outer lip arching forward regularly; margins joined by a thin callus. Length 8, diam. 3.25 mm. (*Bgt.*).

Nice and environs; also reported from Malta, etc.

Ferrussacia gronoviana RISSO, Hist. Nat. Eur. Merid. iv, p. 80, pl. 3, f. 27.—BOURGUIGNAT, Malac. chat. d'If, p. 18, pl. 2, f. 4-6; Etude synon. sur les Moll. Alpes Marit. p. 41, pl. 1, f. 8-10; Malac. de l'Algerie i, p. 43, footnote, pl. 3, f. 19-21.—ISSEL, Bull. Soc. Malac. Ital. i, 1868, p. 20, with var. *vescoi*.

—PFR. Monogr. vi, 249.—GODWIN-AUSTEN, P. Z. S. 1880, p. 662, pl. 64 (anatomy).—NEVILL, P. Z. S. 1880, p. 133, pl. 14, f. 2; with var. *subamblya*, p. 133, var. *subfolliculus*, p. 134, and var. *subforbesi*, p. 134.—*Vediantius cristalinus* RISSO, Hist. Nat. Eur. Merid. iv, p. 82 (young specimen).—*Cionella g.*, WESTERLUND, Fauna, p. 155.

This species is especially distinguished by having the penultimate whorl *much swollen on the left side*. *F. vescoi* is certainly closely related, but the columellar fold is stronger, at least typically. Bourguignat redescribed and figured the species from Risso's type specimen.

Var. *subamblya* Nevill.

"This is a short convex form, with the last whorl a good deal more rounded, the aperture less everted, with the columella straight. They increase very slowly and regularly, the difference of the antepenultimate one in this respect, from that of the typical form, being very marked. It may prove a distinct species; but I am inclined to doubt it at present. I only found a few specimens living with typical form."

"Long. $8\frac{1}{4}$, alt. $3\frac{1}{3}$ millim." (Nevill).

Menton (Nevill).

Var. *subfolliculus* Nevill.

"? *Ferussacia folliculus* Gronovius (as figured by Bourg. Mal. Chateau d'If. pl. ii. fig. 2, long. 9, diam. 3 millim.). A few specimens only met with living with typical *F. gronoviana*; they agree well with the above-quoted figure. The body whorl is more elongately and evenly rounded, not tumid towards the base, and appears longer in proportion than in the typical form." (Nev.)

"Long. 9, diam. $3\frac{1}{2}$ millim.; apert. alt. $3\frac{3}{4}$ millim. (Nev.)

Menton (Nevill).

Var. *subforbesi* Nevill.

"? *Ferussacia forbesi*, Bourg. Mal. Alg. (long $8\frac{1}{2}$, diam. 4 millim., Algiers). I doubt this variety, in especial, being specifically distinct. The whorls of the spire are only slightly irregular; the last whorl more convex, columella straighter.

There is also a smaller form, of which I found only two specimens (of which I also give measurements below), which might be separated again as distinct. The aperture is very small." (Nev.)

Long. $8\frac{1}{4}$, diam. $3\frac{1}{4}$ millim.

Long. $8\frac{1}{2}$, diam. $3\frac{1}{2}$ millim.

Long. $7\frac{3}{4}$, diam. 3 millim. (a small form, perhaps distinct).

All the preceding in Indian Museum, Calcutta. M. Bourguignat informs me by a letter that I sent him, from Menton, specimens of *Ferussacia vescoi*, *amblya*, *procchia*, *forbesi*, and *abromea*. He does not mention *F. gronoviana*." (Nevill.)

8. *F. vescoi* (Bourguignat). Pl. 41, figs. 47, 48, 49.

Shell oblong-subventricose, rather solid, glossy, subpellucid, corneous-buff; spire short, acuminate-tapering, the apex minute, obtuse. Whorls 6, a little convex, irregularly increasing (the first 3 regular, the fourth swollen on the right side and rapidly widening, the rest more rapidly increasing); separated by a superficial, pale-margined suture; the last whorl not half the total length. Aperture lunate-oblong; columella strong, straight, whitish, callous and twisted within, reaching to the base; peristome acute, unexpanded, a little thickened with white inside, outer margin arching forward, margins joined by a callus. Length 9, diam. 4, aperture 4 mm. (Bgt.).

Algeria, especially common around Algiers; Morocco; Tunis; Portugal, Spain, Southern France, Italy, Sicily, Malta.

Glandina vescoi BGT., Amen. Malac. i, (1856) p. 150, pl. 15, f. 2-4 (bad).—*Ferussacia v.*, BGT., Amen. Malac. i, p. 203; Malac. chat. d'If, p. 23, pl. 2, f. 10-13; Malac. de l'Algerie i, p. 44, pl. 3, f. 22-24, with var. *lanceolata* BGT., p. 43, pl. 3, f. 25; Prodr. Malac. Tunisie, p. 117.—PFR., Monogr. iv, 621; vi, 249.—POLLONERA, Bull. Soc. Malac. Ital. xii, p. 121, pl. 4, f. 17 (teeth).—*F. vercoi* PALADILHE, Rev. et Mag. Zool. 1875, p. 89 (Tangier).—*Ferussacia* (?) *abnormis* NEVILL, P. Z. S. 1880, p. 134, pl. 14, f. 3 (young).—*Achatina palustris* PARRYSS, teste Pfr., Nomencl. Hel. Viv. p. 337.

F. gronoviana differs by the smaller size, less ventricose

shape, less callous columella, and especially by the *Streptaxis*-like aspect of the shell, due to the more swollen right than left side, the columellar axis within the shell being a little bent. It is a common shell in most of the countries bordering on the western basin of the Mediterranean. Whether it is always distinguishable from *F. folliculus* is doubtful. *Bulimus nitidissimus* Kryn. is probably either this form or *F. folliculus*.

Ferussacia abnormis Nevill from Blidah, Algeria (and also from Menton) seems to be a half-grown specimen of *F. vescoi* or of one of its immediate allies. Nevill subsequently proposed for it the subgenus *Pseudostreptostyla* (P. Z. S. 1880, p. 665). The original figure is copied, pl. 41, fig. 55.

Bulimus nitidissimus Krynicki. Shell ovate-oblong, acuminate, imperforate, rather solid, pellucid, very glabrous, very glossy, yellowish-corneous. Whorls 6, somewhat flattened, the suture superficial, duplicated. Aperture long, angular, obtuse in front; columella half the length of the lip, somewhat twisted; peristome simple, whitish. Length 4.5, diam. 1.75 lines. Crimea. (Kryn. in Bull. de la Soc. Imp. des Naturalistes de Moscou, vi, 1833, p. 420; cf. Pfr., Monogr. ii, 284).

Var. *lanceolata* Bgt. Pl. 41, fig. 50. Shell like the type but less swollen, more lanceolate, longer; length 10, diam. 3.5 mm. Around Algiers.

Var. *PROECHIA* Bourguignat. Pl. 41, figs. 61. "The *proechia* differs from *F. vescoi* (the only species with which it can reasonably be compared), by the far more slender shape, more elongate, less ventricose; by the diminished columella, decidedly less calloused and less projecting; by the piriform smaller aperture, rounded in its outer margin; and especially by the convex last whorl, proportionally much smaller than that of *vescoi*. Length 9, diam. 3, aperture 3.25 mm." (*Ferussacia proechia* Bgt., Malac. de l'Algerie i, p. 44, pl. 3, f. 26-28 (1864); Prodr. Malac. Tunisie p. 117.—? *Agathina folliculus* var. *elongata* DEBEAUX, Rec. Soc. Agric., Sci. et Arts d'Agén, viii, pt. 2, p. 328, 1857. (Boghar).

Algeria: around Algiers (Let.); Blidah (Brondel), not common. Also Tunis.

Var. *cincta* 'Coutagne' Locard. Same shape as *vescoi*; 6 whorls, increasing in the same manner; shell translucent, hyaline, very elegantly ornamented in the middle of each whorl with a thin, fawn-colored band contrasting with the ground color. Length 9, diam. 4 mm. Rare, in the environs of Collioures, Pyrénées-Orientales. (*Ferussacia cincta* Coutagne LOCARD, Les Coquilles terr. de France, in Ann. Soc. d'Agricult. Lyon, (7), iii, 1895, p. 138).

Var. REISSI (Mousson). Pl. 40, fig. 41.

Shell cylindric-ovate, smooth, very glossy, pellucid, pale corneous. Spire convexly conic, the summit minute, rather acute; suture very smooth, scarcely noticeable, followed by a white margin bordered with a brown line. Whorls $6\frac{1}{2}$, the first 4 slowly and regularly increasing, a little convex, the following 2 more rapidly descending, elongate, last whorl shorter, lightly ovate-rounded, more convex at the base, subopaque anteriorly near the margin. Aperture not acute above; peristome unexpanded, hardly acute; right margin a little retracted at the insertion, well curved, broadly arched forward in the middle; columellar margin appressed, somewhat thickened, continued in a subcallous parietal layer. Columella excavated, distinctly obliquely plicate-truncate below. Length 9, diam. 3.5 mm. (*Mouss.*)

Canary Is.: Teneriffe (Reiss, Watson.)

Cionella reissi MOUSSON, Revue Faune Malac. Canaries, p. 129, pl. 6, f. 26, 27.—PFR. Novit. Conch. p. 109, pl. 125, f. 26, 27.—*Ferussacia r.*, PFR., Monogr. viii, 303.—MABILLE, Nouv. Arch. du Mus. viii, p. 151.—*Lovea r.*, WOLLASTON, Test. Atlant. p. 458.

Hardly separable from *F. vescoi*.

9. F. FORBESI Bourguignat. Pl. 41, figs. 64, 65.

Shell oblong cylindric, smooth, very glossy, pellucid, corneous-buff; spire blunted, the apex obtuse; whorls 5 to 6, a little convex, irregularly widening, the first three regularly, the rest more rapidly increasing, separated by a paler, superficial and duplicated suture; last whorl not half the total

length, buff-whitish at the suture. Aperture lunate-oblong, angular above, whitish within, peristome unexpanded, acute, whitish-thickened somewhat within; columella straight, whitish, twisted within; outer margin regularly arcuate in front, the margins joined by a whitish callus. Length 8.5, diam. 4, length of aperture, 3.75 mm. (*Bgt.*).

Algeria: Algiers (type loc.), Bougie, etc.; Tunis.

Achatina nitidissima FORBES, Ann. of Nat. Hist., or Mag. of Zool. Botany and Geology, ii, p. 253, pl. 12, f. 2 (Dec. 1838). Not *Bulimus nitidissimus* Kryn., 1833, also a *Ferussacia*.—*Ferussacia forbesi* BGT., Aménités Malacologiques i, p. 204, in Revue et Mag. de Zool. 1856, p. 334; Prodr. Malac. Tunisie p. 117.—PFR., Monogr. iv, p. 621; vi, p. 248.

“Differs from *F. amauronia* by the irregular increase of the whorls, more arcuate outer margin, etc.”

10. *F. STENOPHYA* (Westerlund).

Shell related to *Cionella forbesii*, but slender, cylindric-fusiform. Whorls 6, the upper 3 very narrow, together hardly equal to the antepenultimate, this being half the length of the penultimate whorl, which scarcely attains two-thirds the length of the last. Last whorl a little depressed at the aperture, narrowed towards the base. Suture delicate, margined. Aperture piriform, the outer margin strongly arched forward below the middle. Columella short, straight, white. Length 7, diam. 2 mm. (*West.*)

Algeria: débris of the Harrach (Ancy).

Cionella (Ferussacia) stenophya WESTERLUND, Verhandl. k. k. zool.-bot. Ges. Wien, xlii, 1893, p. 43.

11. *F. EXTREMA* (Westerlund).

Shell related to *Cionella forbesii* Bgt. but with 5 whorls, the first two most minute, standing out from the rest; the first three together hardly more than one-third the height of the penultimate whorl; penult. whorl very long, as long as the last or longer, with parallel sides. Suture broadly margined below by a white callous line, dark-edged below, and extending to the apex. Aperture piriform; columella callous; margins

broadly and strongly ivory-labiate within, the outer evenly arcuately produced, nearly from the insertion. Length 8.5 to 9.5, diam. 3 to 3.5 mm. (West.)

Morocco (coll. John Ponsonby).

Cionella (Ferussacia) extrema WESTERL., Verhandl. k.-k. zool.-bot. Gesellschaft in Wien, xlii, 1893, p. 43.

12. *F. MORELETI* Pallary. Pl. 52, fig. 2.

Mr. Pallary believes the form figured by Morelet to be distinct from *F. forbesi*, by its arcuate outer lip and regularly coiled spire. Morelet describes it as "cylindric, smooth, very bright, of a fawn or russet shade, with a rather obtuse spire; 5 to 6½ whorls, noticeably convex, the penultimate a little swollen; the convolution is regular, without marked deviation of the sutural line, which is accompanied by a dark border as in most species of the genus. The straight, short and thin columella runs into the basal margin, without any appearance of truncation. Length 8, diam. 3.5 mm."

Morocco: Mogador and Casa Blanca. (Beaumier).

Ferussacia forbesi MORELET, Journ. de Conchyl. xxviii, 1880, p. 58, pl. 3, f. 9 (not of Bourguignat).—*Ferussacia moreleti* PALLARY, Journ. de Conchyl. xli, 1898, p. 123.

13. *F. ABROMIA* Bourguignat. Pl. 41, figs. 62, 63.

"*F. abromia* is distinguished from *vescoi*, *proechia* etc. by its more regular increase, the shell noticeably costulate, the last whorl a little hollowed out towards the outer margin, instead of being nearly flat as in *vescoi*, or convex as in *proechia*; by the straight columella, not callous or twisted, etc. Length 11, diam. 3.5, aperture 4 mm." (Bgt.).

Algeria: drift of the Harrach, near Algiers, rare; Tunis (Bgt.).

Ferussacia abromia BGT., Malac. de l'Algerie p. 45, pl. 3, f. 29-31 (1864); Revue et Mag. de Zool. xvi, 1864, p. 207; Prodr. Malac. Tunisie p. 117.—PFR., Monogr. vi, 250 — *Cochlicopa abromia* CAFICI, Il Nat. Siciliano i, p. 204.

Bourguignat states that this species lives also in Sicily, but according to Cafici, this has not been confirmed by Sicilian naturalists.

14. F. NEBRODENSIS Benoit.

Shell imperforate, long-fusiform, rather solid, smooth, glossy, corneous; spire long-conic, the apex rounded; suture impressed, narrowly margined. Whorls 7, regularly increasing, the upper but slightly convex, the last cylindric, rounded at base, about two-fifths the total length; columella narrow, arcuate, callous; aperture semioval, angular above; peristome simple, unexpanded, margins joined by a dilated callus. Length 9.5, diam. 3, aperture 3.5 x 2 mm. (*Benoit*).

Sicily: Madonie.

Achatina nebrodensis BENOIT and TIBERI Illustrazione sistematica critica iconographica de' Testacei estramarini della Sicilia ulteriore, pt. 4, p. 235 (1862).—*Ferussacia n.*, BENOIT, Nuovo Catalogo Conch. terr. e fluv. Sicilia, p. 86. — PFR., Monogr. vi, p. 254.

Said by Benoit to belong to the subgenus containing *cylindracea* and *emiliana*, but differing from these by the larger size, long-conic spire, simple peristome, extension of the parietal callus and absense of a parietal tubercle. In his catalogue of 1881 Benoit places it in the *folliculus* group, but states that it is intermediate in shape between *Azeca* and *Ferussacia*. It has not been figured.

15. F. AGILIS (Westerlund).

Shell slender, cylindric-fusiform, summit long-conic, amber reddish, glossy, irregularly striate especially at the suture. Whorls 7, the upper convex, slowly increasing, the lower three more rapidly increasing, a little convex, the last whorl little larger than the penultimate; suture broadly margined, very little descending at the aperture. Aperture subpiriform, long and very narrowly tapering above, dilated below, rounded, the outer margin moderately and regularly arched forward in the middle. Columella short, curved, white, truncate. Length 8 to 8.5, diam. 2 mm. (*Westerl.*).

Algeria: Algiers.

Cionella (Ferussacia) agilis WESTERL., Annuaire du Musée Zoologique de l'Acad. Imp. des Sciences de St. Pétersbourg iii, 1898, p. 175.

Species of Mauritius.

16. *F. BARCLAYI* (Pfeiffer). Pl. 42, figs. 66, 67, 70, 71.

Shell oblong, thin, smooth, corneous; spire convexly conic, the apex rather acute; suture shallow, simple. Whorls 5, a little convex, the penultimate large, last whorl a little shorter than the spire, slightly tapering at the base. Aperture vertical acuminate-oblong; columella oblique and lightly twice-twisted; peristome simple, unexpanded, the right margin sinuate above, subangularly arched forward in the middle. Length 9, diam. 4, aperture 4.5 x 2 mm. (*Pfr.*).

Mauritius (Isle of France), Sir D. Barclay in Cuming coll.; Mt. Oriz and Moka, G. Nevill.

Spiraxis barclayi *PFR.*, Proc. Zool. Soc. 1855, p. 99; Monogr. iv, 580; vi, 197.—*Cionella b.*, MARTENS in Möbius, Reise nach Mauritius, p. 199.—*Ferussacia b.*, NEVILL, Handlist Moll. Indian Mus. i, p. 161.—*Glandina vesiculata* BENSON, SEMPER, Reisen im Archipel Phil., Landmoll. p. 135 (jaw and teeth).

"Only distinguished from its European close ally, *F. folliculus*, by the more turrid last whorl and broader aperture. It lives gregariously under large blocks of stone. The animal is bright yellow and very active. A single one of the living specimens which I found was reversed." (*G. Nevill*).

The shell is composed of 5½ whorls, which increase regularly and very slowly to the penultimate. Here the suture descends much faster so that the penultimate whorl widens rapidly. The whitish sutural border is more conspicuous than the figures indicate. A slightly convex, calcareous, white epiphragm guards the dormant snail, as shown in fig. 71. Specimens measure—

Length 8.6, diam. 3.5, length aperture 4 mm.

Length 10, diam. 4, length aperture 4.5 mm.

Length 8.3, diam. 3.5, length aperture 4 mm.

I am much inclined to believe that this species is an importation from southern France. It would otherwise be very difficult to account for its occurrence in Mauritius.

Semper has examined the mouth-parts of specimens supplied by G. Nevill. The jaw has at least 20 fine riblets; radula

much as described and figured for *F. gronoviana*. Formula 22 to 25, 5, 1, 5, 22 to 25; the central tooth very small, weakly tricuspid, five laterals with a very long middle cusp and two equal side points. The marginals from the 17th out have very finely denticulate cusps.

Species of the Canary Islands.

The Canarian Ferussacias are of Mediterranean type, more or less related to *F. folliculus*. They are oblong shells with weak columellar truncation, and usually a callous band within the lip-edge, producing an external buff stripe behind the lip.

A single specimen of the Madeiran *F. tornatellina* has been reported from Grand Canary, yet it is probably to be looked upon as a chance importation, if indeed the species has actually obtained a Canarian foothold. *Cionella webbii* Mouss. (*Ferussacia w.*, Bourguignat) has been shown by Wollaston to be identical with *Buliminus myosotis*. *F. vescoi reissi* occurs on Teneriffe.

Our knowledge of these species is chiefly due to A. Mousson's *Révision de la Faune Malacologique des Canaries*, 1872, and Wollaston's *Testacea Atlantica*, 1878.

17. *F. VALIDA* (Mousson). Pl. 40, fig. 39.

Shell imperforate, ovate-cylindric, rather solid, very lightly striatulate, very glossy, pale corneous, somewhat milky. Spire long, convexly-conic, the summit minute, rather obtuse, hyaline; suture linear, flat, broadly margined below. Whorls 6, the first nearly flat, slowly increasing, the penultimate more rapidly descending, a little convex, the last whorl long, flatly rounded, more convex at the base. Aperture three-eighths the total length, vertical (five degrees from the axis), long-oval, acute above, subangular below. Peristome straight and white outside, broadly and strongly thickened within, somewhat cuneate anteriorly, the margins joined by a thick lamina; right margin straight above, curved below, arcuately produced in front; basal a little retracted; columella straight, reaching nearly to the base, obsoletely doubly thickened within. Length 15, diam. 5 mm. (*Mouss.*).

Canary Is.: Yandia, Fuerteventura (Fritsch).

Cionella valida MOUSS., Rév. fauna Malac. Canaries, p. 130, pl. 6, f. 24, 25.—PFR., Novit. Conch. iv, p. 108, pl. 125, f. 24, 25.—*Ferussacia v.*, PFR., Monogr. viii, p. 304.—*Lovea v.*, WOLLASTON, Testac. Atlant. p. 459.

A large, solid species, apparently allied to the smaller *F. lanzarotensis*.

18. *F. FRITSCHI* (Mousson). Pl. 40, fig. 38.

Shell imperforate, ovate-elongate, rather solid, very slightly striatulate, very glossy, pale corneous (somewhat milky). Spire long, convex-conic, the apex minute, obtuse, hyaline; suture flat, narrowly margined. Whorls 6, a little flattened, from the third whorl more rapidly descending, the last two long, last whorl very slightly rounded or flat, somewhat expanded in front and below. Aperture subvertical (5 degrees from the axis), three-fifths the total length, oblong-oval, angular above, subangular at the base. Peristome obtuse, unexpanded outwardly and white, broadly thickened within, the margins joined by a rather thin parietal callus; right margin slightly curved, broadly produced in front; columellar margin shortly and delicately expanded, subtuberculate in front at the basal angle. Columella slightly concave, at the base obliquely and obscurely plicose-truncate. Length 10, diam. 3 mm. (*Mouss.*)

Canary Is.: Lanzarote (Fritsch, Wollaston).

Cionella fritschi MOUSS. Rev. fauna Malac. Canaries, 1872, p. 131, pl. 6, f. 30, 31.—PFR., Novit. Conch. iv, p. 110, pl. 125, f. 30, 31.—*Lovea f.*, WOLLASTON, Test. Atlant. p. 459.—*Ferussacia f.*, PFR. Monogr. viii, p. 304.—MABILLE, Nouv. Arch. du Mus. viii, p. 152.

19. *F. LANZAROTENSIS* (Mousson). Pl. 40, fig. 40.

Shell imperforate, subcylindric, smooth, very glossy, pel-lucid, pale corneous. Spire long, convexly conic, irregular, the apex rather obtuse, nucleus hyaline; suture linear, flat, submarginate. Whorls 6-6½, the first 3 regular, a little convex, the two following more rapidly descending, long, flattened, the last whorl smaller, flat, more convex below, sub-

compressed. Aperture vertical (5 degrees with the axis), not over one-third the total length, inversely piriform, acutely angular above, less so below. Peristome unexpanded thickened, broadly labiate, yellow outside, opaque, margins joined by a subcallous layer; right margin thinner above, then convexly thickened within, broadly arcuately produced below, subangular at junction with the oblique columellar margin within. Columellar margin subtuberculate calloused below, with a reflexed callus minutely impressed in the region of the perforation. Columella somewhat excavated, long, the truncation obsolete. Length 10, diam. 2.7 mm. (*Mouss.*)

Canary Is.: Lanzarote, under stones on the ridges above Haria.

Cionella lanzarotensis MOUSS., Rev. fauna Malac. Canaries, p. 133, pl. 6, f. 28, 29 (1875).—PFR., Novit. Conch. p. 110, pl. 125, f. 28, 29.—*Lovea l.*, WOLLASTON Testac. Atlant. p. 460, with var. *tumidula*.

“Judging from a long array of examples which are now before me, this beautiful and rather large *Lovea* (which measured from about $4\frac{1}{2}$ to 5 lines in length) is eminently variable—not only in hue and solidity, but also in exact outline and the relative size of its volutions; nevertheless it may be defined, on the whole, as a cylindrical species, not much tapering towards the apex, with the suture exceedingly oblique, the peristome thick and incrassated, and with the penultimate whorl more or less largely-developed.” (*Wollaston.*)

Wollaston recognizes two forms: the typical *lanzarotensis*, found on the craggy ridges above Haria, with the shell “more solid, more highly polished, and of a paler ochreous-yellow, on the average a trifle narrower and more cylindric, with the penultimate volution a little more tumid, and with the aperture, which is just appreciably shorter, rather more obtusely rounded, or less angular, at the point of junction with the columella,” and

Var. *tumidula* Wollaston. Pl. 40, figs. 43, 44.

“A little less solid, slightly less narrow, cylindric-fusiform, obscure corneous, a trifle less glossy, the penult. whorl generally less noticeably lengthened, subinflated-conic; aperture

slightly longer, posteriorly a little less obtusely rounded, or more angular." Lofty sea-cliff known as the "Risco," overlooking the Salinas, in the extreme north of Lanzarote.

My figures are drawn from a specimen from the Wollaston collection, measuring, length 10, diam. 3.1, length of aperture 3.9 mm., whorls $5\frac{1}{2}$.

20. *F. ATTENUATA* (Mousson). Pl. 40, fig. 42.

Shell imperforate, subfusiform, smooth, very glossy, translucent, pale corneous. Spire concavely tapering, the apex rather acute, nucleus subpapillar, hyaline; suture linear, somewhat impressed, narrowly flatly margined, whorls 7, a little convex, the 5 upper ones subregular, the sixth slowly descending and subelongate, last whorl shorter, regular, more convex at base, subdepressed. Aperture subvertical (10 degrees with the axis), small, inversely piriform, angular above, arcuate below. Peristome unexpanded, very strongly thickened and labiate; margins joined by a callous layer, columellar margin narrowly reflexed and adnate. Columella narrowly excavated, rather straightened, tapering downward with no well marked prominence. Length 9, diam. 2.5 mm. (*Mouss.*).

Canary Is.: northern coast of Lanzarote, on the cliff "Risco."

Cionella attenuata MOUSS., Rev. fauna Malac. Canaries, p. 134, pl. 6, f. 32, 33 (1875).—PFR., Novit. Conch. vi, p. 111, pl. 125, f. 32, 33.—*Ferussacia a.*, PFR., Monogr. viii, p. 306.—MABILLE, Nouv. Archiv du Museum (2 ser.), viii, p. 154.—*Lovea a.*, WOLLASTON, Test. Atlant. p. 461.

"Although relatively a little narrower and more tapering in outline, with usually an extra volution, and with the ultimate and penultimate ones rather less elongated (in proportion to the size of the shell), I am nevertheless far from certain that the present *Lovea* is truly distinct specifically from what I have regarded as the 'var. *B. tumidula*' of the *lanzarotensis*; and this is all the more possible, because I undoubtedly possess many examples which are more or less intermediate between the latter and the *attenuata*, and because

also the *Loveas* are eminently liable (like some of the *Clausilias* and *Pupae*) to have a state which is more or less shortened and obese, and another which is comparatively elongated and acute. Added to which, the *L. attenuata* and what I have cited as a 'var *B.*' of the *lanzarotensis* are found in company (for the most part in about equal proportions),—having been met with hitherto, so far as I am aware, only on the lofty submarine cliffs (known as the Risco, and overlooking the Salinas) in the extreme north of Lanzarote."

"Even of the *L. attenuata*, however, as here understood there appears to be a larger and a smaller state,—differing in nothing, I think, except in size; and therefore as Mousson speaks of his *Cionella attenuata* as being conspicuously smaller than the *lanzarotensis*, it would seem to follow that the comparatively minute examples of the shell were the only ones he possessed from which to compile his diagnosis. The examples which I have measured vary from 4 to nearly $5\frac{1}{2}$ lines in length." (*Wollaston.*)

21. *F. VITREA* (Webb et Berthelot). Pl. 40, figs. 45, 46.

Shell cylindric-fusiform, widest near the base, corneous-yellow, subtransparent, very glossy. Spire gradually tapering with somewhat convex outlines. Whorls $5\frac{1}{2}$, slightly convex, regularly increasing to the last, which descends much more rapidly, so that in back view the penultimate whorl appears nearly as long as the last. Suture slightly impressed, narrowly opaque-margined. The aperture is subvertical, ovate, white within. The outer lip in profile is moderately arcuate, and has no well-defined yellow band at the edge. Parietal callus distinct, transparent. Columella white, nearly straight in a front view, but seen to be distinctly truncated obliquely at the base if viewed obliquely in the aperture. Length 6.7, diam. 2.2, aperture 2.7 mm.

Canary Islands: Lanzarote (Fritsch); Fuerteventura near Sta. Maria Betancuria, in the Rio Palmas and on Monte Atalaya (Wollaston). Reported also from Teneriffe, probably in error.

Achatina vitrea W. et B., Ann. des Sci. Nat. vol. 28, p. 320

(1833).—*Bulimus v.*, ORBIGNY Hist. Canaries, Moll., p. 72, pl. 2, f. 28.—PFR., Monogr. iv, p. 455.—*Cionella v.*, MOUSSON, Rev. fauna Mal. Canaries p. 131.—*Ferussacia v.*, PFR., Monogr. vi, p. 250; viii, p. 303.—*Lovea v.*, WOLLASTON Test. Atlant. p. 462.

“The straightened, rather cylindric-oblong outline of this comparatively small, *very highly polished*, pellucid, and pale greenish-yellow, or olivaceo-corneous *Lovea* (which measures from about 3 to 3½ lines in length), added to the thinness of its substance, the excessive obliquity of its suture, its enlarged and slightly tumid penultimate volution, its acute, unthickened peristome, and its somewhat short and posteriorly rounded (or unangulate) aperture, will sufficiently distinguish it” (*Wollaston*).

“The specimens of this *Lovea* from Lanzarote, which must be looked upon as the normal ones, are a trifle smaller and narrower, and perhaps a little more cylindrical (or less ovate) than those from Fuerteventura; and their columella is, on the *average*, somewhat less truncated behind, or more gradually and imperceptibly rounded off into the hinder margin of the peristome; but the latter character is so unmistakably variable in *both* forms that I would merely register the Fuerteventuran individuals as representing a ‘var. *B. submajor*,’ distinctive of that particular island.” (*Wollast.*)

The description and figs. 45, 46 are drawn from a specimen from the Wollaston collection, taken at Fuerteventura.

Section *Pegea* Risso.

Pegea RISSO, Hist. Nat. Eur. Mérid. iv, p. 88, for *P. carnea* RISSO.—*Pseudazeca* PFR., Monographia Hel. Viv. viii, 1877, p. 299, for *Ferussacia procerula*, *eremiophila*, *lamellifera*, *sciaphila gracilentia*.—*Proceruliana* BGT., Rev. et Mag. de Zoologie 1864, p. 201; Malacologie de l’Algerie ii, p. 24, for *F. procerula* etc.—*Phylacus* WESTERLUND, Fauna etc. iii, 1887, p. 154, for *F. splendens*, *obesa*, *lamellata*.—“*Stobilus* Anton,” H. & A. ADAMS, in part, Genera of Recent Mollusca ii, p. 106, for *achatinoides* Pfr., *cubensis* PFR., *cylichna* Lwe., *fraseri* BS., *lamellifera* Morel., *leacociana* Lwe., *ovuliformis* Lwe. (Jan. 1855). Not *Stobilus* Anton.

Cylindric-fusiform shells with conic spire and a rather long, piriform aperture which is longer and narrower above than in the *folliculus* group; the parietal wall usually bearing a deep-seated entering lamella; columella with one or two callos folds or denticles, tapering but not distinctly truncate at base.

Chiefly African, only one species being found in Italy, doubtless introduced accidentally.

The species of *Pegea* have been chiefly described by Bourguignat in his *Malacologie de l'Algerie* (1864), *Prodrome de la Malacologie terrestre et fluviatile de la Tunisie* (1887) and various shorter papers. In the work on Tunis a classification of the species into the groups used below is given. Westerlund, in part III of his *Fauna der in der Paläarktischen Region lebenden Binnenconchylien* (1887), gives a resumé of the species with abbreviated German descriptions. Finally Kobelt has defined and illustrated most of the valid species in an excellent review in his *Iconographie Land- und Süßwasser-Conchylien*, new series vol. VII, 1896.

F. atava Crosse (Journ. de Conchyl. 1862, p. 166, pl. 7, f. 19, 20; Coquand, Geol. et Pal. Constantine, p. 312, pl. 29, f. 22, 23) is a fossil species from the Pliocene (?) of Ain-el-Hadj-Baba, near Constantine, Algeria.

F. arctica Westerlund. A species measuring 7 x 2.75 mm., having the parietal lamella of the subgenus *Pegia*, believed to have been collected by Charles Rabot in Russian Lapland at Kitza, on the Kola peninsula. The occurrence of a lamellose *Ferussacia* in this frigid region is remarkable, and requires confirmation. (*Ferussacia arctica* WESTERL., Comptes Rendus de l'Acad. des Sci., Paris, vol. 108, 1889, p. 1315, footnote; Nachrbl. d. Malak. Ges. 1889, p. 169).

Group of *F. splendens* (*Phylacus* Westerlund).

Species having the appearance of the *F. folliculus* group, but with a parietal lamella and columellar margin similar to the species of *Pegea*.

22. *F. SPLENDENS* Bourguignat.

Shell relatively quite short, but still oblong, subventricose,

glossy, pale-corneous, very sharply substriatulate or somewhat polished; spire moderately produced, at the summit rather abruptly attenuate, the apex obtuse; whorls 7, slightly convex, somewhat irregularly increasing, the upper whorls slowly, the rest rapidly; separated by a linear and paler suture; last whorl rather large, not half the total length, a little convex. Aperture oblique, receding at the base, rather lunate, irregularly oblong, angular above, outwardly subarcuate, having a lamella within on the parietal wall. Columella strong, straightly descending, acute below, calloused and *quasi* subdenticulate above; peristome unexpanded, obtuse, a little thickened, the outer margin arcuate and produced above, receding at the base; margins joined by a strong callus. Length 11, diam. 3, aperture 5 mm. (*Bgt.*).

Tunis: Medjerda R. at the bridge of Fondouek between Tunis and Utique (*Bgt.*).

Ferussacia splendens BGT., Prodr. Malac. Tunisie p. 117, 1887.

"In shape this species resembles *F. aphelina* a little."

23. *F. OBESA* Letourneux et Bourguignat.

Shell tumid-oblong, obese, very glossy, pale corneous, with a white thread at the suture, polished; spire moderately produced, quite rapidly tapering at the summit, the taper regular, apex stout, obtuse; whorls 6, a trifle convex, regularly increasing to the penultimate, then rapidly increasing, the penult. suture relatively quite rapidly descending; suture linear; last whorl relatively of medium size, slightly over one-third the total length, a little convex. Aperture suboblique, piriform, very angular above, with a lamella, which is minute, deeply immersed, reaching inward on the belly of the penult. whorl. Columella short, little thickened, straightly descending in an oblique direction towards the right; peristome unexpanded, obtuse, whitish, continued in a strong parietal callus; outer margin subobliquely straightly descending. Length 12, diam. 4, aperture 4.5 mm. (*L. & B.*).

Tunis: Djebel Resas (Letourneux).

Ferussacia obesa L. et B., Prodr. Malac. Tunisie p. 118.

Like *F. gronoviana* in shape.

24. *F. LAMELLATA* Bourguignat.

Shell elongate, fragile, translucent, glossy, somewhat whitish, very delicately striate, polished; spire produced, tapering to the obtuse summit; apex obtuse. Whorls 6, a trifle convex, the penultimate more convex; slowly increasing to the penultimate, then rapidly increasing; suture impressed; last whorl moderate, one-third the total length, scarcely convex at the beginning, more convex at the aperture. Aperture vertical, rather lunate, irregularly oblong, arcuate outwardly, angular above, having a strong lamella on the parietal wall. Columella straight, acuminate, above slightly toothed within; peristome unexpanded, acute, the outer margin lightly arcuate; margins joined by a very thin callus. Length 10, diam. 3, aperture 3 mm. (*Bgt.*).

Algeria; neighborhood of Boghar; Tunis: ruins of Carthage.

Ferussacia lamellata BGT., Prodr. Malac. Tunisie, p. 118, 1887.

Resembles *F. proechia* in shape.

25. *F. MARGINATA* (Westerlund).

Shell cylindric-fusiform, fragile, glossy, corneous-reddish. Spire perceptibly attenuate above, the apex obtuse. Whorls 6, a little convex, the upper rather regularly increasing, the last two rapidly; taken together their length on the left side more than two-thirds, on the right nearly three-fourths, and the last whorl alone one-half the total length. Suture superficial, nearly horizontal above, very oblique in the middle, becoming slightly oblique at the aperture, throughout having a white, strongly callous margin. Aperture narrowly piriform, long and narrowly produced above, nearly 4 mm. long; parietal lamella rather immersed, high, compressed, below the middle of the parietal wall; columella white, acute, a little twisted, at the base noticeably running out; outer margin vertical, very lightly arcuate. Length 8, diam. 2.5 mm. (*Westerl.*)

Algeria: Blidad (Ancy).

Ferussacia marginata WESTERL., Bull. Soc. Malac. de France, v, 1888, p. 63.

Group of F. procerula.

Whorls quite convex, the suture pronounced; aperture toothless, but having a small parietal lamella deeply immersed, columella short, straight delicate, acuminate below, the other margin thin; increase of whorls regular (excepting *F. procerula*), a little accelerated at the penult. whorl.

26. *F. PROCERULA* (Morelet). Pl. 43, fig. 1.

Shell fusiform-elongate, rather solid, very lightly striatulate, glossy fulvous; spire long-conic, apex a little obtuse. Whorls 6 to 7, subplanulate, separated by a linear, submarginated suture, the upper slowly, the last two rapidly increasing, the last whorl hardly as long as the spire, somewhat tapering basally. Aperture subvertical, edentulous, irregularly ovate, acuminate at both ends; peristome obtuse, the outer margin a little arcuate, produced in the middle, very lightly thickened outwardly. Length 12.5, diam. 4, aperture 5 mm. (*Kobelt.*)

Algeria: La Calle, type locality; Bone, Hammam-Meskoutin, Constantine and Algiers; Tunis: Kerez, Djebel Resas.

Glandina procerula MOREL., Journ. de Conchyl. ii, 1851, p. 357, pl. 9, f. 12; iii, 1853, p. 292.—*Achatina p.*, PFR., Monogr. iii, p. 511.—*Ferussacia procerula* BGT., Amen. Malac. i, p. 198, pl. 19, f. 7-9; Malac. Algerie ii, p. 46, pl. 4, f. 3-7; Prodr. Malac. Tunisie p. 119.—KOBELT, Iconogr. vii, 1896, p. 25, pl. 186, f. 1176.

Though without a parietal lamella, this species clearly belongs to the subgenus *Pegea*.

27. *F. LITTORALIS* Bourguignat.

Shell elongate, glossy, subpellucid, pale corneous, polished; spire long, rather regularly tapering, apex obtuse; whorls 7, convex, regularly increasing, parted by a relatively deep suture; the last whorl more than a third the total length, convex. Aperture suboblique, oblong-piriform, acutely angular above, having a very minute lamella deep in the mouth, visible in oblique view; columella relatively short, moderate, acuminate, lightly curved, within denticulate above; peristome

unexpanded, subacute, a little thickened within and somewhat whitish; outer margin regularly arcuate; margins joined by a thin callus. Length 13, diam. 4, aperture 5 mm. (*Bgt.*)

Tunis: debris of the Oued Sidi-Aich; Algeria: around Calle and Bone.

F. littoralis BGT., Prodr. Malac. Tunisie p. 119, 1887.

"Remarkable for the regularity of its spiral increase and the convexity of the whorls."

28. *F. EULISSA* 'Let.' Bgt.

Shell oblong-elongate, rather swollen, obese, very obtuse at the summit, glossy, fragile, smooth, pale corneous. Spire oblong, slightly acuminate but obtuse; apex obtuse, white. Whorls 6, a little convex, the upper slowly, the rest rapidly increasing, separated by a paler superficial and duplicated suture, the last whorl two-fifths the total length, a little convex, slightly descending to the lip-insertion. Aperture rather lunate, oblong-piriform, acutely angular above, convex below, with a deeply immersed very minute median parietal lamella. Columella short, straight, lamellar. Peristome acute, unexpanded, whitish, slightly thickened within. Outer margin arched forward, the margins joined by a very thin callus. Length 10, diam. 3 mm. (*Bgt.*).

Algeria: Djebel-Thaya, Hammam-Meskhoutin and ravine of the Rummel near Constantine; Tunis: debris of the Oued Sidi-Aich.

F. eulissa Letourneux, in BOURGUIGNAT, Species Novissimæ molluscorum in Europæo Syst. detectæ p. 33 (1876); Prodr. Malac. Tunisie p. 119.

"Remarkable for its obtuse spire."

Group of *F. nympharum*.

Shape somewhat *Alexia*-like.

29. *F. NYMPHARUM* Letourneux et Bourguignat.

Shell long-oblong, moderately shining and pellucid, dark corneous or somewhat olivaceous, paler at the summit and

buff on the lip; polished; spire oblong, regularly tapering; the apex a little obtuse; whorls 7, slightly convex, regularly but still rather rapidly increasing, separated by a linear suture, the last whorl rather large, nearly half the total length, a little convex. Aperture slightly oblique, elongate, acutely angular above, subangular below at the base of the aperture, outwardly arcuate, somewhat whitish within, and having a minute lamella deep within on the parietal wall. Columella strong, thick, straightly descending, subdenticulate above, somewhat subtruncate below. Peristome unexpanded, a little obtuse, thickened a little within, the outer lip scarcely arcuate; margins joined by a thin callus. Length 13, diam. 4, aperture 6 mm. (*Bgt.*).

Tunis: Temple of the Nymphs at Djebel Zaghouan, rare, in shady places; Djebel Bou-Kournein.

F. nympharum BGT., Prodr. Malac. Tunisie p. 119, 1887.

30. *F. SUBSACCATA* 'Ancy' Westerlund.

Shell narrowly oblong, rather thin, glossy, corneous, finely striate. Spire regularly tapering above, rather blunt. Whorls 7, rather regularly, the lower rather rapidly increasing, somewhat convex with linear suture; the last whorl long, regularly convexly contracted. Aperture produced, narrowed above, vertical, with a strong parietal lamella visible in oblique view; outer margin elliptical, base regularly arcuate. Columella obliquely plicate-twisted within, with a strong tooth above, acuminate below, not truncate. Outer lip obtuse, but scarcely thickened, nearly straight, a little retracted below; parietal callus thin. Length 12, diam. 4, aperture 5 mm. (*Westerl.*).

Algeria: Biban, Constantine province.

Cionella subsaccata Ancy MSS., WESTERLUND Fauna der in der Paläaretischen Region Lebenden Binnenconch., Suppl., p. 48, 1890.

Group of F. hagenmulleri.

Shell oblong, quite long, with nearly flat whorls, superficial suture, and regular spiral increase; aperture toothless or lamellate; columella short, robust; outer lip a little thickened.

31. *F. HAGENMULLERI* Bourguignat.

Shell elongate, glossy, a little opaque, corneous or somewhat corneous-buff, polished; spire long-oblong, regularly tapering, the apex a little obtuse, whorls 7, slightly convex, regularly increasing, parted by a linear paler suture; the last whorl slightly convex, over a third the total length. Aperture vertical, lunate, irregularly subovate, angular above, whitish within, with a minute parietal lamella. Columella straight, stout, white, acuminate yet subtruncate below, inwardly with one or two tooth-like prominences. Peristome straight, acute, thickened with white within; outer margin regularly arcuate; margins joined by a thin callus. Length, 13, diam. 4, aperture 5 mm. (*Bgt.*).

Algeria: Roknia, near Hammam-Meskhoutin, type loc.; Djebel Thaya and Rummel ravine near Constantine, etc., etc.; Tunis: El Aouine, etc. Djebel Recas, a larger, corneous orange-yellow form.

F. hagenmulleri BGT., Prodr. Malac. Tunisie p. 120, 1887.

32. *F. EREMIOPHILA* Bourguignat. Pl. 43, figs. 2.

Shell fusiform-elongate, rather solid, glossy, subpellucid, smooth, or sometimes indistinctly substriate under the lens, corneous-buff. Spire long, conic, the apex obtuse. Whorls 7, a little convex, *regularly* increasing, parted by a paler, duplicated suture, the last whorl more than one-third the total length. Aperture lunate, oblong, with a deeply immersed lamellar callosity in the middle of the parietal wall, which in some specimens is very strong, in others wanting or nearly so. Columella straight, whitish, slightly twisted, not truncate, and having a small tubercle above another smaller one sometimes towards the base; peristome unexpanded, acute, the outer lip lightly arched forward; margins joined by a rather strong callus. Length 13, diam. 4, aperture 5 mm. (*Bgt.*).

Algeria: widely spread in the province of Constantine, environs of Constantine, type loc. Tunis: Porto Farina; Djebel Recas.

F. eremiophila BGT., Amen. Malac. i, p. 199, pl. 19, f. 20-23; Malac. Algerie ii, p. 48, pl. 4, f. 1-4; Prodr. Malac. Tunisie p. 120.—KOBELT, Iconogr. n. F. vii, p. 30, pl. 187, f. 1186.

Distinguished from *F. procerula* by the less ventricose longer shell, wider aperture, and regular increase of the whorls. Bourguignat states that the parietal lamella is variable, but according to Kobelt, who also collected it around Constantine, it is always present.

33. *F. MONTANA* Bourguignat.

Shell oblong-tumid, very glossy, pellucid, corneous, polished; spire oblong, regularly tapering, the apex a little obtuse. Whorls 7, slightly convex, regularly coiled to the penultimate whorl, then rapidly increasing; suture linear, at the penult. whorl deeply descending; last whorl large, nearly half the total length, rather convex, slowly descending above. Aperture nearly vertical, oblong-piriform, acutely angular above, having a strong parietal lamella. Columella short, whitish, acuminate, subdenticulate inwardly above; peristome unexpanded, acute, a little thickened and whitish; outer margin regularly arcuate, the margins joined by a strong callus. Length 15, diam. 5, aperture 7 mm. (*Bgt.*).

Algeria: Djebel Maadid, between Hodna and Medijana; summit of Mahmel, 2306 meters. Tunis: Djebel Recas, ruins of Utique, etc.

Possibly a form of *F. carnea*.

F. montana BGT., Prodr. Malac. Tunisie p. 120, 1887.

34. *F. ORANENSIS* Bourguignat. Pl. 43, fig. 3.

Shell long-fusiform, glossy, smooth, subpellucid, corneous, the spire slightly acuminate, apex a little obtuse, paler; whorls 7, slightly convex, irregularly increasing, the upper regularly, the fifth more dilated, the rest large, separated by a paler superficial bordered suture; last whorl over one-third the total length. Aperture long-piriform, acutely angular above, rounded basally; columella whitish, small, the base not truncate; peristome unexpanded, acute; outer margin curving forward towards the base, margins joined by a thin callus. Length 12, diam. 4, aperture 5 mm. (*Bgt.*).

Algeria: valley of Ued Djebbara near Oran.

F. oranensis BGT., Rev. et Mag. Zool. xx, 1868, p. 374, pl.

15, f. 5-8; Moll. nouv., litig. etc. p. 269, pl. 40, f. 5-8.—PFR., Monogr. viii, p. 301.—KOBELT, Iconogr. vii, p. 27, f. 1179.

Closely resembles *F. lamellifera*, but lacks a parietal lamella.

Group of F. carnea.

Shell comparatively opaque, with a strong parietal lamella, outer lip thick, with a strong callus; the spiral increase quite regular (except in *F. lamellifera*). It is especially a Tunisian group, but one species occurs in Italy, where Bourguignat believes it to have been introduced.

35. *F. CARNEA* (Risso). Pl. 43, figs. 4 to 8.

Shell cylindric-turrite, rather solid, little shining, opaque, smooth or very lightly, irregularly striatulate, buff or rufous-corneous. Spire shortly conic, gradually tapering. Whorls 7, flattened, parted by a distinct, margined, duplicated suture; the upper whorls are flat and increase very slowly; the antepenult. whorl is much more convex, the last two larger, separated by a very oblique suture. The last whorl does not descend, is rounded below, and about half the total length; behind the mouth it is broadly bordered with yellow. Aperture nearly vertical, ovate, acute above, two-fifths the total length. Deep on the parietal wall a compressed entering parietal lamella stands. Peristome unexpanded, the margins joined by a distinct callus; outer lip thickened with a thin whitish callus; more or less produced forward in the middle. Columella short, vertical, twisted, more or less bidentate. In oblique view the upper denticle frequently appears as a more or less pronounced horizontal fold, the lower as a truncation. Length 12 to 15 diam. 4 to 5 mm. (*Kobelt*).

Northern Tunis and in the prov. of Constantine, Algeria, common and generally distributed. Introduced in the islands Pianosa and probably Alicuri, and formerly at Nice.

Pegea carnea RISSO, Hist. Nat. Eur. Merid. iv, p. 88, pl. 3, f. 20, 1826.—*Ferussacia carnea* BOURGUIGNAT, Moll. Alpes Maritimes p. 52, pl. 1, f. 23-25; Malac. Algerie p. 50, pl. 3, f. 32-35.—Prodr. Malac. Tunisie p. 121.—KOBELT, Iconogr. n. F. vii, p. 33, pl. 188, figs. 1193-1197.

Tornatellina fraseri Benson MSS., PFR. Monogr. Hel. Viv. iii, p. 526; iv, 652; vi, 260.—*Helix munita* FERUSSAC MSS., teste Bgt.

? *Achatina lamellifera* Morel., BENOIT, Illustrazione sistematica, critica, iconografica de' Testacei estramarini della Sicilia etc., p. 242, pl. 5, f. 28.

This is an exceedingly abundant species in Tunis, quite variable, found in multitudes in the stony grain fields, and its introduction in Italy was doubtless owing to accidental mixture with exported grain. It was originally described from Nice, but whether still found living there is not known. Kobelt, who collected at the original localities, considers the following Tunisian forms to be merely selected specimens, described by Bourguignat "with sovereign disregard of transitional and intermediate forms."

F. stenostoma Bourguignat. Shell oblong-subfusiform, little shining, a little opaque, thick and opaque on the last whorl, towards the aperture, corneous, very delicately striatulate, polished; spire oblong, rather abruptly attenuate at the summit, apex minute but still somewhat obtuse. Whorls 7, slightly convex, regularly and slowly increasing to the penult., then rapidly increasing, parted by a linear suture; last whorl large, a little convex, slightly tapering downward. Aperture vertical, narrowly long-oblong, angular above and below, whitish within, with a strong parietal lamella. Columella stout, straight, lamellose, acuminate, yet subtruncate at base, within it is subdenticulate above. Peristome unexpanded, obtuse, a little thickened and whitish within; outer margin regularly subarcuate, margins joined by a callus. Length 13, diam. 4, alt. of aperture 5.5 mm. (Bgt.)

Tunis: Ruins of Utique, type loc.; Djebel Zaghouana near the temple of Nymphs.

F. stenostoma BGT., Prodr. Malac. Tunisie p. 121, 1887.

F. gibbosa Bourguignat. Shell obese-oblong, rather tumid, the left side more convex than the right as in *F. gronoviana*, glossy, subpellucid, corneous, polished. Spire obese, little produced, rather rapidly tapering, the apex a little obtuse. Whorls 7, a little convex, the convexity slightly greater on

the left than on the right side, rather slowly increasing to the penult. whorl, then rapidly, parted by a whitish linear suture; the last whorl large, half the total length, quite convex. Aperture vertical, irregularly oblong, within whitish, and having a strong parietal lamella. Columella stout, short, white, acuminate, within rather strongly denticulate above. Peristome straight, acute, thickened with white within; outer lip almost straightly descending, slightly retracted towards the base, margins joined by a strong callus. Length 11, diam. 4, aperture 5.5 mm. (*Bgt.*)

Tunis: environs of Bizerte; Djebel Recas.

F. gibbosa BGT., Prodr. Malac. Tunisie p. 122.

F. punica Bourguignat. Shell long-cylindric, above rather abruptly tapering, below rather strongly convex and produced to the right at the outer margin of the aperture, a little glossy, subopaque, thick at the aperture and base, corneous, polished. Spire long, cylindric, apex minute, but a little obtuse. Whorls 7, slightly convex, or rather, subplanulate; rather rapidly and regularly increasing, separated by a linear suture; last whorl quite convex on the right at the outer lip, very opaque and as though projecting in a crest below at the columella. Aperture subvertical, irregularly oblong, acute above, within whitish, and with a strong parietal lamella. Columella straight, strong, either acuminate or a little truncate at the base, within denticulate above; peristome whitish, unexpanded, obtuse, slightly spreading below, thickened within; outer margin nearly straight, receding at base; margins joined by a strong callus. Length 14, diam. 4, aperture 5 mm. (*Bgt.*).

Tunis: ruins of Utique and Carthage, Djebel Recas etc. Algeria, around Constantine.

F. punica BGT., Prodr. Malac. Tunisie p. 122, 1887. Kobelt's fig. 1193, copied in my pl. 43, fig. 8, represents this form.

F. polyodon Letourneux et Bourguignat. Shell elongate, slightly more convex on the left than on the right margin, glossy, rather opaque, the last whorl more opaque, pale corneous, finely striatulate but polished; spire produced, regularly tapering, the apex minute, a little obtuse; whorls 7, a little convex, regularly increasing, separated by a slightly im-

pressed suture, sublinear between the last whorls. Last whorl slightly more than one-fourth the total alt., a little convex, thick at the base. Aperture vertical, irregularly oblong, three-toothed,—a parietal lamella, a denticle on the upper part of the columella, and the third strong and tuberculiform in the outer wall. Columella straight, robust, thick; peristome unexpanded, obtuse, thickened as though labiate, the outer margin arched in a little in the middle, margins joined by a strong callus. Length 13, diam. 4, aperture 5 mm. (*Bgt.*)

Tunis: Djebel Resas (or Rsass).

F. polyodon L. & B., Prodr. Malac. Tunisie p. 122, 1887.

F. doumeti Bourguignat. Shell swollen, rather short, oblong-egg-shaped, glossy, subpellucid, corneous, very sharply striatulate, polished; spire little produced, abruptly tapering and at the summit rapidly acuminate, the apex very minute. Whorls 7, slightly convex, the upper four very small, closely coiled (as in *F. maresi*), fifth large and swollen, the rest ample and oblong, separated by a linear suture, usually marked with a white line at the last whorl. Last whorl large, nearly half the total length, a little convex. Aperture vertical, oblong, angular above, whitish and with a strong parietal lamella within. Columella short, thick, white, straight, acuminate, strongly denticulate within above, the denticle visible in oblique view. Peristome unexpanded, obtuse, white-thickened within; outer lip slightly arcuate, margins joined by a callus. Length 13, diam. 5, aperture 6 mm. (*Bgt.*).

Tunis: Djebel Bou-Kournein, type loc.; El-Aouina; Carthage.

F. doumeti BGT., Prodr. Malac. Tunisie p. 123, 1887.

Var. PAULUCCIANA Pollonera. Pl. 43, fig. 10.

Differs from *F. carnea* by the less swollen shell, generally smaller, the spire regularly tapering and higher, the penultimate whorl not inflated, last whorl smaller, the aperture less high. Length 11 to 12, diam. 3.75 to 4, aperture 4.25 to 4.5 mm. (*Poll.*).

Italy: island of Pianosa.

Ferussacia carnea ISSEL, Crociere del 'Volante' 1878, p. 46,

in Ann. Mus. Civ. Stor. Nat. Genova, xi, p. 454, fig. 8.—PAULUCCI, Materiali etc., p. 35; Bull. Soc. Malac. Ital. xii. p. 37.—*F. paulucciana* POLLONERA, Boll. Mus. Zool. ed Anat. Comp. Torino, xx, no. 517, p. 7, figs. 7, 8, and var. *subcarnea*, l. c., figs. 5, 6. (Dec. 4, 1905.)

Var. *subcarnea* Poll. Pl. 43, figs. 11.

Differs from the type by the slightly more swollen shell, the spire less regularly tapering, last two whorls more rapidly widening. Length 11 to 11.5, diam. 4, alt. apert. 4.5 mm. Same locality.

Probably the shell described and figured by Benoit from the island of Alicuri, under the name *Achatina lamellifera* Morel., is a form of *F. carnea*, as Kobelt has surmised.

36. *F. MARESI* Bourguignat.

Shell oblong, rather short, very glossy, pellucid, corneous, polished; spire a little produced, suboblong, rather abruptly truncate and at the summit slender, subcylindric; apex minute, a little obtuse. Whorls 7, slightly convex, the first 4 very small and narrowly coiled, fifth larger and the rest relatively very large, separated by a paler linear suture; last whorl large, half the total length, a little convex. Aperture vertical, oblong, very angular above, somewhat widened at the outer basal margin, whitish and bilamellate within, one strong lamella at the columella, the other, tooth-like, at the upper part of the columella. Columella short, white, straight, acuminate; peristome straight, a little obtuse, thickened within and whitish. Outer lip strongly arched forward, the margins joined by a strong callus. Length 11, diam. 3.25, aperture 5.5 mm. (*Bgt.*)

Algeria: near Ain-Melila, Bone and Constantine. Tunis, Oued Sidi-Aich.

F. maresi BGT., Prodr. Malac. Tunisie p. 123, 1887.

37. *F. LAMELLIFERA* (Morelet). Pl. 44, fig. 13.

Shell subfusiform-oblong, rather solid but pellucid, very glossy, brownish-yellow, spire conic, the apex rather acute; suture flat, accompanied by a narrow opaque band, sharply

defined below. Whorls 6 to 8, the upper very slowly increasing and scarcely distinguishable, the last two much more rapidly increasing in height, separated by a very oblique suture, flat, the last cylindric, its height measured in front two-thirds, at the back hardly half the total alt. Columella nearly vertical, calloused, obliquely truncate at the base, in oblique view indistinctly toothed within, sometimes with two small denticles. Aperture elliptical, rounded below; a deep-seated compressed lamella stands on the parietal wall; outer lip unexpanded, obtuse, weakly thickened outside, arched forward in the middle, the margin connected by a strong callus. Length 10, diam. 3.5, aperture 5 mm. (*Kobelt*).

Algeria: around Bona, type loc.; also widely distributed in Constantine Province, often larger, 13 x 4.5, aperture 6 mm.

Glandina lamellifera MORELET, Journ. de Conchyl. 1851, p. 358, pl. 9, f. 13—*Tornatellina* l., PFR., Monogr. iii, 525.—*Azeca* l., PFR., Monogr. iv, 648; vi, 259.—*Ferussacia* l., BOURGUIGNAT, Rev. et Mag. Zool. 1856, p. 330; Amen. Malac. i, p. 200, pl. 19, f. 13-16; Malac. Algerie ii, p. 53, pl. 3, f. 39-41.—KOBELT, Iconogr. vii, p. 25, f. 1177.

Two specimens figured show the variation in shape. It has been reported from Domenico Reina, Alicuri island, but that form probably belongs to *F. carnea*.

38. *F. AGRÆCIA* Bourguignat. Pl. 44, fig. 14.

Shell cylindric-lanceolate, rather solid, smooth, glossy, subpellucid, corneous-buff; spire long, acuminate, apex small, a little obtuse. Whorls 7, subplanulate, regularly increasing, separated by a paler superficial, obscurely duplicated suture, the last whorl about two-fifths the total length. Aperture subvertical, lunate, angular above, semioval, with a strong whitish compressed and entering parietal lamella deeply placed at the middle of the parietal wall. Columella short, twisted, bicallose, a quite prominent median callosity and a smaller one at base of the columella, which appears as if truncated. Peristome unexpanded, acute, thickened and whitish within; outer lip feebly arched forward; margins joined by a callus. Length 15, diam. 4.5, apert. 5.5 mm. (*Bgt.*)

Algeria: around Saida.

F. agræcia BGT., Malac. de l'Algerie ii, p. 51, pl. 3, f. 36-38 (1864).—KOBELT, Iconogr. vii, p. 33, pl. 187, f. 1192.

"Stands very near *F. lamellifera*, but the whorls increase regularly." (Kobelt).

Group of F. charopia.

Shell elongate, with regular, rather slow spiral increase.

39. *F. DACTYLOPHILA* Issel. Pl. 43, fig. 12.

Shell slender, cylindric-fusiform, long, very glossy, pellucid, smooth, pale corneous, under a lens very minutely longitudinally striate. Spire tapering above, the apex a little obtuse. Whorls 7-7½, irregularly increasing, the upper whorls rather regularly increasing, fourth dilated, the rest very large, separated by a paler duplicated suture, last whorl over one-third the total length. Aperture long-piriform, subangular below, with a median parietal lamella. Columella whitish, straight, slightly calloused, subtruncate; margins joined by a very thin callus. Length 11.75, diam. 3.5, aperture 4.5 mm. (Issel).

Tunis: Oasis of Gafsa, in the Tunisian Sahara, type loc., at Carthage etc., etc. Also known from Algeria at El Kantara, Biskra and Boghari.

F. dactylophila ISSEL, Annali del Museo Civico di Storia Naturale di Genova, xv, p. 274, with fig. in text, 1880.—LET. et BOURGUIGNAT, Prodr. Malac. Tunisie p. 124.—*F. isseli* BGT. MSS.

40. *F. BARATTEI* Letourneux et Bourguignat.

Shell oblong, fragile, pellucid, glossy, corneous, polished; spire rather produced, tapering in an oblong shape, the apex obtuse. Whorls 7, slightly convex, slowly increasing to the fifth, then a little more rapidly, separated by a linear paler suture; the last whorl large, a little convex, nearly half the total length. Aperture vertical, oblong, very angular above, appearing toothless, but obliquely lamelliferous, the lamella small, deeply immersed. Columella short, slender, acumin-

ate, nearly straight or a little curved, having an internal denticle above, visible in oblique view; peristome unexpanded, acute, outer margin a little arched forward, margins joined by a very thin callus. Length 11, diam. 3, aperture 5 mm. (*Bgt.*).

Tunis: Ain-Cherichira, amphitheatre of El Djem and Kef El Djerdja.

F. barattei L. & B., Prodr. Mal. Tunisie p. 125.

41. *F. CHAROPIA* Bourguignat. Pl. 44, fig. 15.

Shell cylindric-lanceolate, rather solid, pellucid, glossy, polished, smooth, under the lens obsoletely striatulate, pale corneous; spire long, apex paler, obtuse; whorls 7, slightly convex, gradually increasing, separated by a paler suture, which seems doubled, last whorl a little more than one-third the total length. Aperture oblong, whitish within, having a median strong thick whitish parietal lamella. Columella white, stout, twisted, callous. Peristome unexpanded, lightly thickened, the outer lip regularly arched forward, margin joined by a whitish callus. Length 10, diam. 3, aperture 3.5 mm. (*Bgt.*)

Algeria: Ain-Smeida and rocks of Sel near Djelfa, type loc. and in the provinces of Oran and Constantine. Tunis, Oued Sidi-Aich, etc., etc.

F. charopia BGT., Malac. de l'Algerie ii, p. 54, pl. 4, f. 6-10 (1864); Prodr. Malac. Tunisie p. 124.—KOBELT, Iconogr. vii, p. 29, pl. 187, f. 1184.

Resembles the group of *F. procerula* in its evenly increasing whorls, but it has a strong parietal lamella.

42. *F. LALLEMANTI* Bourguignat.

Shell slender, elongate, somewhat cylindric, very fragile, very transparent, nearly whitish and polished; spire long, regularly tapering, a little obtuse at the summit. Whorls 7, a little convex, regularly increasing, separated by a linear but lightly impressed suture; last whorl a little convex, one-third the total length. Aperture vertical, oblong, with a minute parietal lamella. Columella slender, straight, acumin-

ate. Peristome unexpanded, acute; outer margin nearly straightly descending but still lightly receding at base, the margins joined by a transparent, hardly visible callus. Length 10, diam. 3, aperture 3.25 mm. (*Bgt.*).

Algeria: environs of Boghar, type loc. Tunis, Guelaat-es-Snan and Foum-Goubel.

F. lallemanti Bgt., Prodr. Mal. Tunisie p. 125, 1887.

F. pechaudi Bgt., is an undescribed form of this group from Algeria. See Prodr. Malac. Tunisie p. 116, footnote no. 2.

Group of *F. gracilentia*.

Shell more or less lengthened, always thin, fragile, and with the whorls irregularly, but rather rapidly increasing.

43. *F. GRACILENTA* (Morelet). Pl. 44, fig. 17.

Shell elongate, almost fusiform, glossy, smooth, translucent, of a handsome brownish-yellow color. Spire attenuate, with rather acute apex; whorls more than 6, nearly or quite flat, separated by a flat, pale-edged, only indistinctly duplicated suture; upper whorls slowly increasing, the last two very rapidly, the last less than half the total length, not tapering below, but rather enlarged there. Aperture somewhat piriform, acute above, wide below, shorter than the spire. A small, compressed parietal lamella stands deep on the parietal wall, visible in oblique view only. Columella quite short, callously thickened, not truncate below, and in oblique view showing a tubercle above. The outer lip is only a little arched forward in the middle. Length 9, diam. 3, aperture 3.5 to 4 mm. (*Kob.*).

Algeria: Cherchell, in the province of Algiers.

Glandina gracilentia MORELET, Journ. de Conchyl., vi, 1857, p. 41, pl. 1, f. 4, 5.—*Azeca gracilentia* PFR., Monogr., iv, 649; vi, 259.—*Ferussacia g.*, BOURGUIGNAT, Rev. et Mag. Zool., xvi, 1864, p. 210.—KOBELT, Iconogr., vii, p. 27, fig. 1180.

The parietal lamella is not visible in a front view in the specimens I have seen. It is very small and deeply immersed. The outer lip arches well forward below the middle, in profile view.

44. *F. YEFFRIANA* Pallary. Pl. 44, fig. 16.

This species is characterized by the outer margin more arched forward than in any other *Ferussacia*. In shape it is most related to *F. gracilentia* Morelet, but our species is distinguished by the large size, more ventricose form, the upper apertural lamella a little indicated, and especially by the advance of its peristome. In *F. yeffriana*, as in *F. gracilentia*, the upper whorls are coiled regularly and then present a noticeable deviation at the penultimate whorl. Length 9.5, diam. 3.25 mm. (*Pallary*).

Algeria: Oran, in the cool ravines of the *massif* of Djebel Yeffri.

Ferussacia yeffriana PALL., Compte Rendu de la 29me Session de l'Association Francaise pour l'Avancement des Sciences Paris, 1900, p. 734, pl. 11, f. 15-18 (1901).

45. *F. DIODONTA* Bourguignat. Pl. 44, fig. 20.

Shell slender, long-fusiform, glossy, pellucid, smooth, pale corneous; spire slowly tapering, the apex a little obtuse, whorls 6, slightly convex, irregularly increasing, the first whorls rather regularly, the last rapidly increasing, separated by a superficial paler and bordered suture; last whorl more than half the total length. Aperture long-piriform, with a minute, deep-seated median parietal lamella and a whitish oblong palatal lamella. Columella whitish, straight, lightly calloused above; peristome unexpanded, acute, the outer lip arching forward, margins joined by a very thin callus. Length 10.5, diam. 3, aperture 4.5 mm. long. (*Bgt.*).

Algeria: Valley of Ued Djebbarra, Oran, type loc.

F. diodonta BGT., Rev. et Mag. Zool., 1868, p. 375, pl. 15, f. 9-13; Moll. nouv. litig., etc., p. 271, pl. 40, f. 9-13.—PFR., Monogr., viii, p. 309.—KOBELT, Iconogr., vii, p. 26, f. 1178 (copied from *Bgt.*).

Remarkable for its palatal plica. Known from the type lot only.

46. *F. SUBGRACILENTA* Bourguignat.

Shell elongate, cylindric, shortly acuminate at the summit, slightly dilated below, glossy, translucent, fragile, pale corneous; spire cylindric-elongate, almost suddenly acuminate at the sum-

mit; apex paler, stout. Whorls 6, all irregularly increasing, separated by a paler, duplicated, superficial suture, the last half the total length, convex, rather dilated on the right side. Aperture long, acutely angular above, rather dilated below, with a deeply-placed very minute parietal lamella. Columella short, whitish, straight, lamellar, denticulate in the upper part. Peristome unexpanded, acute, whitish, outer margin produced forward, margins joined by a thin callus. Length 9.5, diam. 2.5 mm. (*Bgt.*).

Algeria: Mouth of the Cheliff, prov. Oran.

F. subgracilentia BGT., Species noviss., etc., p. 34, 1876.

"This *Ferussacia* is especially characterized by the irregularity of its whorls. The first whorl is regular; the second is wide on the right, narrow on the left side; the third, inversely, is narrow on the right, wide on the left; the fourth, narrow on the right, is excessively developed on the left; finally the last two are much lengthened and follow a descending direction, the descent especially rapid between the fourth and penult whorls" (*Bgt.*).

47. *F. ABIA* Bourguignat. Pl. 44, fig. 18.

Shell minute, lanceolate, cylindric, very slender, glossy, pellucid, smooth, buff-corneous. Spire attenuate, the apex a little obtuse. Whorls 6, flattened, the first 3 regularly and slowly widening, fourth larger, more rapidly increasing, a little more convex on the left side, the rest larger; suture pale, superficially duplicated; last whorl rather convex, over one-third the total length. Aperture oblong-piriform, with a deep-seated whitish parietal lamella. Columella whitish, straight, lamellar within and generally calloused above. Peristome acute, unexpanded; outer margin strongly arched forward, margins joined by a thin callus. Length 7, diam. 2, aperture 3 mm. (*Bgt.*).

Algeria: common around Algiers, etc. Tunis: Oued Sidi-Aich.

F. abia BGT., Malac. de l'Algerie ii, p. 65, pl. 4, f. 31-34 (1864); Prodr. Malac. Tunisie p. 125.—KOBELT, Iconogr., vii, p. 29, pl. 187, f. 1185.

"So similar to *F. gracilentia* that Westerlund ranks it as a subspecies of that. The chief difference is in its more slender, pronouncedly fusiform shape, smaller size, the reduced or wholly wanting parietal lamella and the somewhat more strongly forwardly-arched outer lip" (*Kobelt*).

48. *F. TERVERI* Bourguignat. Pl. 44, fig. 19.

Shell rather small, cylindric-fusiform, very glossy, pellucid, polished, pale corneous or corneous-fulvous; spire a little lengthened, gradually acuminate-tapering; apex paler, a little obtuse. Whorls 6, a little convex, the first regularly increasing, the rest more rapidly, separated by a rather impressed paler, duplicated suture; last whorl convex, nearly half the total length. Aperture piriform-oblong; having a minute, very deeply immersed, hardly visible parietal lamella. Columella simple, straight, sometimes lamellar within and having a callosity above. Peristome unexpanded, acute, the outer margin arcuate especially below; margins joined by a very thin callus. Length 7 to 8, diam. 2.5 to 3, aperture 3.5 mm. (*Bgt.*).

Algeria: very common around Algiers; Blidah, Bougie, etc.

Achatina folliculus TERVER, Catal. Moll. Afric. p. 31, pl. 4, f. 16, '17 (1839).—*F. terveri* Bgt., Amen. Malac. i, p. 208 (1856); Malac. de l'Algerie ii, p. 64, pl. 5, f. 1-3.—KOBELT, Iconogr. vii, p. 31, pl. 187, f. 1188.

Smaller than *F. gracilentia*, less lanceolate, the last whorl generally larger than the spire, the aperture less dilated below, the parietal lamella smaller, very deeply immersed and generally not visible.

Group of *F. letourneuxi*.

Remarkable for the brilliant gloss of the shell, the abruptly attenuate spire and the very irregular increase of the whorls.

F. aristidis Bgt. is an undescribed species of this group from Algeria. See Prodr. Mal. Tunisie, p. 116, footnote 3.

49. *F. LETOURNEUXI* Bourguignat. Pl. 44, fig. 23.

Shell large, long-oblong or tumid-subfusiform, glossy, pellucid, smooth, corneous. Spire long, rather shortly acuminate-tapering at the summit, the apex paler, minute. Whorls 8

irregularly increasing, the upper flat, the rest a little convex, the first narrow and small, the sixth large, last very large, separated by a paler, superficial, duplicated suture; last whorl large, two-fifths the total length, convex, shortly and suddenly deflexed at the upper insertion of the lip. Aperture narrow, elongate, angular above, a little convex outwardly, angular below at the base of the columella, with a thick, produced parietal lamella within. Columella straight, thick, lamelliferous, the lamella superior, deeply placed. Peristome unexpanded, whitish, obtuse, a little thickened within; outer margin lightly arched forward, margins joined by a strong callus. Length 18, diam. 6 mm. (*Bgt.*).

Algeria: Summit of Mt. Guerium, between Constantine and Tebessa; Mt. Maadid, between Hodna and Medjana (*Letourneux*).

F. letourneuxi BGT., Species novissimæ Moll. in Eur. syst. detectæ, p. 32 (1876).—*Cionella letourneuxi* Bgt., WESTERLUND, Fauna, iii, p. 164.

This species is the largest of its group. It is figured from a specimen measuring, length 16.5, diam. 5.7, aperture 7.8 mm.

Var. *grossa* 'Ancey' Westerlund. Somewhat smaller, slenderer, less ventricose, thick-shelled; aperture smaller; columella broad, callously thickened, toothless; parietal lamella callous, generally hardly emerging. Length 15 to 16 mm. Algeria at Ain M'lila (*Westerl.*, Fauna, Supplement, p. 48, 1890).

50. F. BERTHIERI Bourguignat.

Shell oblong, very much attenuate at the summit, very glossy, subpellucid, opaque and rather thick at the aperture, polished, pale corneous or milky; spire moderately produced, almost suddenly tapering, and at the summit more slender and sub-acuminate, the apex rather obtuse. Whorls 7, the first 4 small, a little convex and closely coiled, the fifth larger and more convex, penult. and last large. Suture linear, rapidly descending between the fifth and penult. whorls; last whorl but slightly convex at the beginning, becoming more convex at the aperture. Aperture vertical, piriform-elongate, very angular above, with a parietal lamella. Columella straight, acuminate, rather strongly toothed inwardly above. Peristome obtuse, thick,

spreading, the outer lip a little arcuate; margins joined by a strong callus. Length 12, diam. 4, aperture 5 mm. (*Bgt.*).

Tunis: rock-crevices north of Porto Farina.

F. berthieri BGT., Prodr. Malac. Tunisie, p. 125.

51. *F. MICROXIA* Bourguignat. Pl. 44, fig. 22.

Shell lanceolate-piriform, pellucid, very glossy, very smooth, uniform corneous, obscurely radiate around the suture as in *F. abromia*, or encircled by a paler zone. Spire oblong, rather suddenly attenuate at the upper whorls, apex obtuse, mamillate. Whorls 7, a little convex, the first irregularly, last rapidly increasing, separated by a paler, superficially duplicated suture; last whorl large, over one-third the total length, regularly descending to the aperture. Aperture nearly vertical, lunate-oblong, angular above and below, having a narrow, deeply placed parietal lamella. Columella twisted, whitish, callous, with a very strong lamella above. Peristome whitish, a little thickened, the outer margin slightly arcuate in front, margins joined by a thin callus. Length 12, diam. 3.5 mm. (*Bgt.*).

Algeria: Ued Cheliff, prov. Oran.

F. microxia BGT., Moll. nouv., litig., etc., 1868, p. 303, pl. 43, f. 14-16.—PFR., Monogr., viii, p. 309.—KOBELT, Iconogr., vii, p. 32.

52. *F. CELOSIA* Bourguignat. Pl. 44, fig. 21.

Shell cylindric-fusiform, lanceolate, solid, very glossy, subpellucid, smooth, amber-orange, especially towards the aperture. Spire lanceolate-acuminate, the apex projecting, a little obtuse, as though mamillate, whitish, calcareous. Whorls $7\frac{1}{2}$ to 8, flattened, irregularly increasing as in *F. sciaphila*, separated by a paler, superficial, duplicated suture. Aperture narrowly oblong, angular above, somewhat whitish within, with a deeply placed whitish parietal lamella; columella straight, whitish, bicallose, the upper callus stronger. Peristome unexpanded, lightly thickened; outer margin strongly arched forward, margins joined by a transparent but rather thick callus. Length 11.5, diam. 3.25, aperture 5 mm. (*Bgt.*).

Algeria: Bona, type loc. Tunis: Bizerte.

F. celosia BGT., Malac. de l'Algerie ii, p. 57, pl. 4, f. 14-16 (1864); Prodr. Malac. Tunisie p. 125.—*Cionella eclosia* Bgt., WESTERLUND, Fauna Pal. Reg. Moll. iii, p. 165.

"Differs from *sciaphila* by the more lanceolate, more fusiform shell, the spire not attenuate but acuminate, the summit prominent and lanceolate, the first two whorls atrophied, *replaced by calcareous material*; finally by the columella, which has the upper tubercular prominence stronger and more projecting than the lower" (*Bgt.*).

53. *F. SCIAPHILA* Bourguignat. Pl. 43, fig. 9.

Shell cylindric-fusiform, solid, very glossy, pellucid, smooth, amber-orange, especially towards the aperture. Spire attenuate, the apex obtuse, mamillate. 7 whorls, nearly flat, the first 4 small, increasing slowly and regularly, the fifth increasing disproportionately rapidly, more convex on the left side; last whorl not over half the total length. Suture superficial, with a border below. Aperture narrowly oblong, angular above, with a rather deeply immersed white, strong parietal lamella. Columella straight, whitish, twisted, having two small tubercles. Peristome unexpanded, a little thickened; outer lip strongly arched forward; margins united by a transparent but well-marked callus. Length 11, diam. 4, aperture 5 mm. (*Bgt.*).

Algeria: Bona, under stones in shady places.

F. sciaphila BGT., Malac. de l'Algerie, ii, p. 56, pl. 4, f. 11-13; Amen. Malac., i, p. 201, pl. 19, f. 17-19 (1856).—KOBELT, Iconogr., vii, p. 30, pl. 187, f. 1187.

54. *F. CIRTANA* Bourguignat. Pl. 45, fig. 25.

Shell oblong-ventricose, fragile, pellucid, very glossy, very smooth, uniform corneous, with a whitish zone around the suture; spire tapering, apex obtuse, as though mamillate. Whorls $6\frac{1}{2}$, flattened, the last a little convex, the upper small, last two more rapidly increasing, separated by a superficial, duplicated suture; last whorl large, regularly descending, convex at the aperture. Aperture vertical, lunate-oblong, acutely angular above; columella whitish, short, truncate at the base, the outer lip lightly arched forward, peristome unexpanded,

simple, margins joined by a diaphanous callus. Length 9.5, diam. 4 mm. (*Bgt.*).

Algeria: Rocks of Mansurah near Constantine (Brondel); not found there by Kobelt.

F. cirtana BGT., Moll. nouv., litig., etc., ii, p. 256, pl. 37, f. 6-8.—PFR., Monogr., viii, p. 302.—KOBELT, Iconogr., p. 31.

Distinguished by its swollen shape, short spire and the absence of a parietal lamella.

55. *F. ENNYCHIA* Bourguignat. Pl. 45, fig. 26.

Shell slender, cylindric, pellucid, diaphanous, smooth, polished, very glossy, tawny-buff. Spire attenuate, conic, apex acute. Whorls 6, flat, separated by a paler corneous superficially duplicated suture; the upper whorls minute, slowly and regularly increasing; the third large, suddenly enlarging, swollen on the left side; the last whorl not half the total length. Aperture ovate-oblong; peristome simple, acute, unexpanded, columella straight, slightly twisted or sinuous. Outer margin a little arcuate; margins joined by a thin callus. Length 9, diam. 3, aperture 4 mm. (*Bgt.*).

Algeria: around Bona, type loc.; Tunis at Ain-Draham, opposite the island of Tabarque.

F. ennychia BGT. Rev. et Mag. Zool. 1856, p. 332; Amen. Malac. i, p. 202, pl. 19, f. 10-12; Malac. de l'Algerie ii, p. 87, pl. 4, f. 17-19; Prodr. Malac. Tunisie p. 126.—PFR., Monogr. iv, 620.—KOBELT, Iconogr. vii, p. 29.

Close to *F. mabilleana*, but longer, more cylindric, with one more whorl.

56. *F. MABILLEANA* Paladilhe. Pl. 45, fig. 27.

Shell imperforate, cylindric-lanceolate, slightly subpellucid, rather solid, smooth, glossy, pale slightly greenish buff; spire attenuate, subobliquely conoid, apex a little obtuse, rather projecting and submamillate. Whorls 5, slightly convex, separated by a linear, paler-margined suture, the earlier ones slowly, the later very rapidly increasing, the first two minute, with horizontal suture, third large, subgibbous on the left side, the suture below very oblique, fourth whorl very long, cylindric-subovate. Last whorl half the total length, regularly and

deeply descending at the aperture, the free margin convexly arcuate. Aperture rather narrowly arcuately subpiriform, acutely elongated above; peristome unexpanded, simple, a little obtuse, slightly thickened. Columella short, vertical, somewhat twisted, truncate below, somewhat calloused. Right margin lightly concave-arcuate; margins joined by a rather conspicuous callus continuous with the columella. Length 9, diam. 3.66, aperture 4.25 mm. (*Palad.*).

Morocco, drift of the Souani near Tangier, type loc.; Doukkala (Kleinschmidt).

F. mabilleana PALAD., Revue et Mag. de Zool. 1875, p. 89, pl. 6, f. 19-22.—MORELET, Journ. de Conchyl. 1880, p. 59.—PALLARY, J. de C. 1898, p. 124, pl. 9, f. 4.—KOBELT, Iconogr. vii, p. 28, pl. 186, f. 1182.—MARTENS, Nachrbl. der D. Malak. Ges. 1900, p. 122.

This form has a marked resemblance to *F. vescoi*, but belongs near *F. debilis*, according to Kobelt. Paladilhe reports *debilis* from the same locality.

57. *F. DEBILIS* (Morelet). Pl. 45, fig. 1.

Shell small, narrowly ovate-fusiform, translucent, smooth, very glossy, corneous-brown. Spire short, attenuate with acute apex, whorls 6, slightly convex, irregularly increasing, separated by a pale bordered suture, superficially appearing duplicated; the first 4 increase slowly, the last two are much higher, of nearly equal height. The last whorl comprises half or slightly more of the total length, and tapers slightly below. Aperture ovate-piriform, acute above; peristome thin, sharp, simple, the outer lip arcuate and rather protracted; margins joined by a thin callus. The parietal wall has no callus of any kind. Columella short, straight, not reaching to the base, not tuberculate but covered with a whitish callus, indistinctly truncate at the base. Length 7, diam. 3 mm. (*Kobelt.*)

Algeria: around Philippeville and Bona.

Glandina debilis MOREL., Journ. de Conchyl. iii, 1852, p. 416, pl. 12, f. 6.—*Ferussacia d.*, BGT., Amen. Malac. i, p. 206, pl. 19, f. 1-3; Malac. Algerie pl. 4, f. 20, 21.—PFR., Monogr. iv, 622; vi, 251.—Kobelt, Iconogr. vii, p. 27, pl. 186, f. 1181.

58. *F. TENELLA* ('Ancey' Westerlund).

Shell slender, very thin, elongated, very glossy, light corneous. Spire moderately long, obtuse, whorls 6, somewhat convex, the upper regularly increasing, the fourth somewhat larger, the penultimate suddenly large with very oblique suture; last whorl oblong, large, nearly cylindric. Suture linear, margined. Aperture long, narrow and long in the upper part, wider below; outwardly nearly straight, base arcuate, no parietal lamella. Columella straight within, moderately thickened, white, toothless, hardly truncate, forming a weak angle with the base. Outer lip moderately acute; the margins connected by a distinct glossy callus. Outer lip strongly produced forward below the middle, at the base retracted. Length 8, diam. 2.5, aperture 3.66 mm. (*Westerl.*)

Algeria: Forest of Feruane, between Ben-Chikoa and Berzouaghia.

Cionella tenella Ancey mss., WESTERL., Fauna etc., Supplem., p. 48, 1890.

59. *F. WESTERLUNDIANA* ('Ancey' Westerlund).

Shell slim, cylindric-elongate, very glossy, reddish-corneous. Spire somewhat attenuate above, with rather obtuse apex. Whorls 6, somewhat convex, the first three regularly increasing, the fourth larger, the penultimate large, the last somewhat elongate. Suture bordered below, very oblique between the penult. and the last whorls, more horizontal near the mouth. Aperture elongate, narrow and long above, without a parietal tooth, but having a small, scarcely projecting tubercle deep within; margins delicately united. Columella scarcely thickened within, nearly straight, vertically truncate, not dentate. Peristome blunt, the outer lip vertical, arcuate and produced forward below the middle, retracted at the base. Length 7.5, diam. 2.5, aperture 3.33 mm. (*Westerl.*).

Kabylia: Fort National.

Cionella westerlundiana Ancey, WESTERLUND, Fauna, etc. Supplement, p. 48, 1890.

60. *F. BOURLIERI* ('Ancey' Westerlund).

Shell slender, fusiform, fulvous-corneous, very glossy; whorls 6, slightly convex, the first three very slowly increasing, penultimate more than twice the height of the antepenultimate, about a third shorter than the last whorl. Suture margined, strongly ascending towards the aperture. Aperture narrow, 4 mm. long, produced upward in a very long and very acute angle. Parietal wall slightly convex, obliquely straightened, subsinuous at the straight, vertical columella. Length 7 to 7.5, diam. 2.33 mm. (*West.*)

Algeria: 35 kilometers east from Boghari.

Cionella (*Ferussacia*) *bourlieri* Ancey in sc., WESTERLUND, Verhandl. k.-k. Zool.-Bot. Ges. Wien, xlii, p. 43, 1893.

"Related to *C. debilis* Mor."

Group of F. scaptobia.

Shell egg-shaped. *F. belloiri* Letourneux, *F. numidica* and *F. atlasica* Bgt., are undescribed Algerian species, mentioned by Bourguignat in his *Prodrome de la Malacologie de la Tunisie*, p. 117.

61. *F. COSSONI* Letourneux et Bourguignat.

Shell ovoid-oblong, comparatively swollen, very glossy, subpellucid, corneous, polished; spire obese, at the summit regularly acuminate, yet with a slightly obtuse apex. Whorls 7, a little convex, regularly and slowly increasing to the fifth, then more rapidly increasing, separated by a linear suture, whitish at the last whorl. Last whorl large, half the total length, moderately convex. Aperture vertical, irregularly oblong, with a minute parietal lamella within. Columella short, arcuate, subtruncate below, and in oblique view, showing a very deep-seated tooth above. Peristome unexpanded, whitish, a little thickened, the outer margin a little arcuate; margins joined by a thick callus. Length 13, diam. 5, aperture 6.5 mm. (*Bgt.*).

Tunis: Djebel Resas and Porto Farina; a var. *minor* at Djebel Zaghouan.

F. cossoni L. & B., Prodr. Malac. Tunisie, p. 126.

62. *F. SCAPTOBIA* Bourguignat. Pl. 45, fig. 28.

Shell small, oblong, very fragile, diaphanous, polished, smooth, pale corneous. Spire short, rather acute, the apex obtuse. Whorls 6, hardly convex, the first regularly increasing, the last two large, separated by a superficial duplicated suture, the last half the total length or longer. Aperture long-piriform, acutely angular above. Columella straight, slightly whitish, slightly twisted, subtruncate, and not reaching the base of the aperture. Peristome acute, unexpanded, fragile, the outer margin lightly arched forward, margins joined by a very thin callus. Length 6.5, diam. 2.5, aperture 3 to 3.5 mm. (*Bgt.*).

Algeria: around Constantine, Philippeville, Bougie, etc.; a rare species.

F. scaptobia BGT., Amen. Malac., i, p. 207, pl. 19, f. 4-6 (1856); Malac. Algerie, ii, p. 61, pl. 4, f. 23-25.—PFR., Monogr., iv, 622.—KOBELT, Iconogr., vii, p. 32.

Smaller than *F. debilis*, more delicate, more fragile and less glossy; the spire is shorter, increase more regular; the aperture is longer and narrower in its upper part. Known only by Bourguignat's account.

Madeiran Ferussaciæ.

With the exception of *F. folliculus*, probably introduced, the Madeiran species of *Ferussacia* have probably diverged from a single stock, or perhaps two allied stocks, which reached the archipelago in early tertiary time. The forms with parietal and supraparietal lamellæ have probably retained more characters of the old stock, while those with toothless apertures seem to be secondarily simplified. The occurrence of lamellæ on the parietal wall in several otherwise diverse Madeiran branches apparently points to this conclusion. Such lamellæ, when present, are homologous with those of continental tertiary and recent species of *Azeca*, *Pegea*, *Calaxis*, etc., and can hardly be of independent origin.

Original sources of information on Madeiran *Ferussaciæ* are Lowe's several papers, cited below, Watson's descriptions of the soft parts, and Wollaston's excellent résumé in the *Testacea*

Atlantica, 1878. I have used in the following account large series of most of the species, including a set from the Lowe-Wollaston collection and a series collected by Mr. Grabham.

Key to Madeiran Species of Ferussaciadæ.

- a. Shell minute, fragile, very slender, whitish-corneous, with straightly tapering spire and obtuse apex.

Genus *Cæcilioides*.

- a¹. Shell ovate or oblong, not as above.

- b. Outer lip straight in profile, obtuse, with a thickened rim within; columella not truncate or plicate.

Cochlicopa lubrica.

- b¹. Outer lip more or less arcuate or sinuous in profile; columella plicate or truncate.

- c. Whorls few, 4 to 4½; aperture with parietal and columellar lamellæ and sometimes palatal folds.

(*Cylichnidia*.)

- d. Shell ovate, aperture with no palatal folds; length 3.6 to 4 mm. *F. ovuliformis*, no. 73.

- d¹. Shell cylindric-oblong; a strong lower palatal fold developed; length 2.7 to 3 mm.

F. cylichna, no. 74.

- c¹. Whorls 5 to 8.

- d. Outer lip lined with a whitish callus.

- e. Outer lip in profile sloping strongly forward from the suture downward; aperture very narrow and acuminate above.

- f. Shell about 11.5 x 5 mm.; parietal wall smooth or with a very weak supraparietal thickening.

F. melampoides, no. 63.

- f¹. Shell from 9 x 4 to 6.5 x 3 mm.; a rather long vertical supraparietal fold. *F. tornatellina*, no. 64.

- f². Shell narrower, about 8.5 x 3.1 mm.; supraparietal fold short and toothlike. *F. mitriformis*, no. 65.

*f*³. Shell about 8.5 x 2.5 mm.; parietal callus thin, foldless; callus within the outer wall thin.

F. producta, no. 68.

*e*¹. Outer lip moderately arched in profile view, subvertical in general direction.

f. Shell oblong, 8 to 8.5 mm. long; parietal callus thin and smooth, columellar fold rather weak.

F. folliculus, no. 1.

*f*¹. Shell ovate, 6 to 7 mm. long.

g. A strong entering parietal lamella. *F. triticea*, no. 66.

*g*¹. No distinct parietal lamella; a low supraparietal nodule.

F. oryza, no. 67.

*d*¹. Outer lip thin, without an internal callus.

e. Outer lip very strongly arcuate in profile, retracted above; shell 3.7 x 1.6, aperture 1.5 mm.

F. leacociana, no. 72.

*e*¹. Outer lip moderately arcuate in profile.

f. Shell very fragile, 4 x 1 mm.

F. gracilis, no. 71.

*f*¹. Shell larger, 5 to 7 mm. long.

F. terebella, no. 70; *F. iridescens*, no. 69.

Subgenus AMPHORELLA Lowe.

Amphorella LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 120 (for *A. mitriformis*; *A. tornatellina* also mentioned), P. Z. S., 1854, p. 202, type *A. tornatellina*.—*Agraulina* BOURGUIGNAT (in part), Revue et Magazin de Zoologie, Dec., 1858, p. 530, 537, for *triticea*, *oryza*, *tuberculata*, *tornatellina*, *melampoides*, *mitriformis*.—*Lovea* WATSON, P. Z. S., 1875, p. 677, for *melampoides*, *tornatellina*, *triticea*, *oryza*.

Shell rather large and solid, ovate; upper part of the aperture very narrow, acuminate, the outer wall strongly thickened within; outer lip in profile *descending obliquely forward*; parietal

wall smooth or with a supraparietal fold; columella strongly plicate basally. Type *F. tornatellina*.

63. *F. MELAMPOIDES* (Lowe). Pl. 38, figs. 1, 2.

The shell is fusiform-ovate, pale brownish-yellow with a white subsutural band followed by a gray line; glossy, weakly striatulate. The spire has nearly straight outlines, the apex obtuse. Whorls $5\frac{1}{2}$, nearly flat, the penult. and last slightly convex. The linear suture descends obliquely in its last half turn, and is shortly deflexed at the aperture. The aperture is subvertical, ovate-lanceolate. The outer lip bends forward in a broad curve below, has a blunt edge, and a large white callus within. The parietal callus is rather thick, transparent, and bears a low, indistinct, vertical supraparietal callus. Columella white, concave above and below a rather strong, simple projecting fold. Length 11.7, diam. 5, length of aperture 7.7 mm.

Madeiran Archipelago: Ilheo de Cima, off the southeastern extremity of Porto Santo, common under large stones. Also found fossil on Porto Santo.

Helix melampoides LOWE, Trans. Camb. Phil. Soc., iv, p. 60, pl. 6, f. 24 (1831).—*Achatina melampoides* LOWE, PRK., Monogr., iii, 510; Conchyl. Cab., p. 317, pl. 25, f. 31, 32.—*Oleacina melanopsoides* H. & A. ADAMS, Gen. Rec. Moll., ii, p. 47.—*Lovea melampoides* WATSON, P. Z. S., 1875, p. 679 (description of animal).—WOLLASTON, Test. Atlant., p. 257.—*Achatina tornatellina* var. *maxima* PAIVA, Mar. Moll. Mader, 1867, p. 112.

Closely related to *F. tornatellina*, but larger, with less strongly twisted columella, less oblique lip, seen in profile view, and less developed callosities on the parietal wall. It is a very local species, found living only on one tiny islet, though a few fossil specimens have been taken at Porto Santo.

64. *F. TORNATELLINA* (Lowe). Pl. 38, figs. 3, 4, 5, 6.

The shell is fusiform-ovate, pale yellowish-brown, with a white subsutural border, glossy, weakly marked with growth-lines. Spire with nearly straight outlines. Whorls over 6, narrow and slowly increasing, the last suture hardly oblique to the preceding. Aperture lanceolate, forwardly oblique, the outer lip sloping obliquely forward towards the base (fig. 6);

edge blunt, interior calloused. The parietal callus is moderately thick, and bears a vertical white ridge above (supraparietal lamella); below the lower end of this and more immersed, there is the weak blunt rudiment of a parietal lamella. The short white columella projects as a strong lobe, entering spirally and subhorizontally.

Length 9, diam. 4. aperture 6 mm.

Length 6.5, diam. 3 mm. (Pt. Sao Lourenço).

Madeira: common almost everywhere; also on the Southern and Grand Desertas and on the Pico Branco in Porto Santo. Fossil at Caniçal.

Helix tornatellina LOWE, Trans. Camb. Philos. Soc. iv, 1831, p. 59, pl. 6, f. 23.—*Achatina t.*, PFR., Monogr. ii, p. 277; Conchyl. Cab. p. 373, pl. 37, f. 34, 35.—*Glandina t.*, ALBERS, Moll. Mader. p. 58, pl. 15, f. 11, 12 (1854).—*Lovea t.*, WATSON, P. Z. S., 1875, p. 680, 678, figs. 1-5 (living animal, jaw and teeth).—WOLLASTON, Testacea Atlant., p. 258.

Closely related to *melampoides*, but smaller, with more oblique outer lip as seen in profile, and with a well-developed supraparietal lamina. It has also more whorls. Figures 3, 4, represent the var. *minor* of Wollaston, from Pt. Sao Lourenço, length about 6.5 mm.

Wollaston recognizes three forms: “(a), *major* [= typical *tornatellina*] is found principally in sylvan districts at comparatively high elevation in Madeira, rather large, ventricose and highly colored, with the subvertical ventral plait elongate and narrow, and the columella a good deal (and abruptly) expanded at the base; the *second*, β [*minor*], which is also common in Madeira proper, but is more particularly characteristic of the exposed submaritime cliffs, is, on the average, smaller, and not quite so rounded, generally a trifle paler in hue with the subvertical ventral plait a little shorter and more dentiform (or more abruptly terminated behind), and with the columella not quite so broad; whilst the *third* γ [*intermedia*], which is met with sparingly on the two Southern Desertas and on the summit of Pico Branco in Porto Santo, is somewhat intermediate in stature between the ‘a’ and ‘ β ’, and has the subvertical ventral plait (although scarcely dentiform as in the (‘ β ’) distinctly

expressed and rather further removed from the angle of the lip, and the inner medial tubercle not altogether obsolete—it being, although indistinct, quite appreciable. These varieties, however, pass gradually into each other, and are of too trifling importance to need separate subspecific titles," (Wollaston.)

Var. GRABHAMI Pilsbry, n. v. Pl. 40, figs. 33, 34.

The shell resembles the small form of *tornatellina* in shape; but the very thick outer lip is *inflexed*, with an inwardly projecting lobe below the middle; supraparietal plait short and narrow; parietal nodule low but distinct. Length about 6, diam. 2.8 mm.

Madeira: Ponta Sao Lourenço, fossil (M. Grabham).

Six examples taken by Mr. Grabham agree in the remarkable development of the lip. It is a phylogerontic form, doubtless extinct, and probably very local, since it does not seem to have been found by former naturalists.

65. F. MITRIFORMIS (Lowe). Pl. 38, figs. 13, 14.

Similar to *F. tornatellina minor*, from which it differs by the more slender shape, slightly more produced spire and the shorter, tooth-like supraparietal prominence. There are usually a couple of very low nodules within the outer lip, opposite the supraparietal tooth. Length 8.5, diam. 3.1, length aperture 4.9 mm.

Madeira, the Desertas, and Porto Santo on the Pico Branco; fossil on the Southern Desertas.

Achatina mitriformis LOWE, Ann. and Mag. Nat. Hist. (2 Ser.), ix, 1852, p. 120; P. Z. S. London 1854, p. 203.—*Lovea m.*, WOLLASTON, Test. Atlant. p. 260.

Some examples are shorter than that figured, yet still distinguishable from *tornatellina* by the short, tooth-like supraparietal plait.

Section FUSILLUS Lowe.

Fusillus LOWE, Ann. Mag. Nat. Hist. (2), ix, 1852, p. 120 (for *A. oryza*, *tuberculata*, *terebella*); P. Z. S., 1854, p. 204, type *A. oryza*. —*Alsobia* BOURGUIGNAT, Rev. et Mag. Zool., 1858, pp. 530, 535, type and sole species *A. paroliniana* W. et B. —*Agraulina* Bgt. (in part), t. c., pp. 530, 537.

Shell ovate; outer wall of aperture calloused within; profile of outer lip arcuate; parietal wall with a supraparietal fold and parietal lamella, or the latter may be wanting; columella strongly plicate at base. Type *F. oryza*.

Closely related to *Amphorella*, but the aperture is less narrow above and the outer lip less oblique in profile.

66. *F. TRITICEA* (Lowe). Pl. 38, figs. 7, 8.

The shell is long-ovate, pale brown or brownish-yellow, with a white subsutural border, glossy. Whorls $5\frac{1}{2}$, the last more obliquely descending. Aperture ovate, slightly oblique, heavily white-calloused within; the outer lip is nearly straight in profile, being very weakly arched-forward in the middle. Parietal callus moderately thick, transparent; parietal lamella strong and high, entering about a half whorl (fig. 8); no supraparietal lamella. Columella not truncate at base, but bearing a median callosity. There is usually a long, low and indistinct palatal lamella deep within, opposite the parietal lamella.

Length 6.8, diam. 2.9, length of aperture 3.25 mm.

Length 6, diam. 2.6 mm.

Porto Santo: under stones in profusion, often associated with the next species.

Helix *C[ochlicopa]* *triticea* LOWE, Trans. Cambridge Philos. Soc., iv, p. 60, pl. 6, f. 25, and var. *biplicata*, p. 61; P. Z. S., 1854, p. 205.—*Achatina triticea* PFR., Monogr., ii, 278; iii, 522; vi, 258.—*Lovea triticea* WOLL., Test. Atlant., p. 255.—*Achatina paroliniana* WEBB et BERTHELOT, Ann. des Sci. Nat., xxviii, 1833, p. 320.—*Bulimus parolinianus* ORBIGNY, Hist. Nat. des Iles Canaries, Moll., p. 73, pl. 3, f. 27.

Lowe in his first article considered this species and the next to be varieties of a single species, designating the one as *biplicata* the other as *edentula*. Wollaston has ably discussed the synonymy, showing that the type of *A. paroliniana* is *F. triticea* and the alleged Canarian locality is without reputable basis. Mabille (Nouv. Arch. du Mus. viii, p. 148) has wasted ink on the subject.

F. triticea is related to *F. oryza*, but readily distinguished by the conspicuous parietal lamella and stronger columellar fold. Lowe's type measured length 6, diam. 3 mm.

67. *F. ORYZA* (Lowe). Pl. 38, figs. 10, 11, 12.

Shell similar to *triticea* except in the aperture. The blunt and slightly sinuous outer lip has a heavy smooth white callus within. The parietal callus bears a low oblong supraparietal nodule, but no parietal lamella, and the columella, though well twisted within, shows nearly straight in a front view. Length 6, diam. 2.7 mm.

Porto Santo: common under stones on the mountains. Also found as a fossil.

Helix triticea var. *edentula* LOWE, Trans. Cambr. Philos. Soc. iv, 1831, p. 61, pl. 6, f. 26 (not *Helix edentula* Drap.).—*Bulimus parolinianus* ORB. (in part), Moll. Canaries, pl. 2, f. 29.—*Achatina oryza* and *A. tuberculata* LOWE, Ann. and Mag. N. H. (2 ser.) ix, p. 120 (Feb. 1852).—*Achatina tandoniana* SHUTTLEWORTH, Bern, Mittheil. 1852, p. 293.—*Lovea oryza* Lwe., WOLLASTON, Test. Atlant. p. 252.—*Azeca triticea* and *A. oryza* BGT., Revue et Mag. Zool. 1858, pp. 537, 538.

Certainly related to the externally very similar *F. triticea*, but in *oryza* the parietal lamella is wanting or reduced to an indistinct rudiment.

The variety *tuberculata* Lowe (pl. 38, fig. 9) differs by being larger, more ventricose, with the supraparietal tubercle larger and the parietal lamella represented by an amorphous callus. Length 6.7, diam. 3 mm.

The reported occurrence of this species in the Canary Islands has been shown by Wollaston to be based on error. The type of the supposedly Canarian *A. tandoniana* was from Pico Branco, in Porto Santo.

Section *Hypselia* Lowe.

Hypselia LOWE, P. Z. S., 1854, p. 202, type and sole species *A. producta*.

Shell fusiform-ovate, *thin*, the outer wall of the aperture with a thin internal callus or none; parietal wall smooth; columella more or less plicate. Type *F. producta*.

The type of this group is intermediate between *Amphorella* and such forms as *F. terebella*.

68. *F. PRODUCTA* (Lowe). Pl. 39, figs. 24, 25.

"Related to *Achatina acicula* Müll., but the shell is double the size, more solid and robust, with an entirely different appearance. It differs from *A. gracilis* Lowe by the more solid shell, not hyaline, the aperture obliquely produced backward and narrowed upwards, the columella prominently, distinctly truncate or emarginate at base" (Lowe, 1852).

Shell rather large, somewhat strong, subpellucid, turrite, subcylindric-subulate, slender, long; spire produced. Whorls 8, quite flat; suture rather indistinct, oblique. Aperture narrowly elliptical, narrowly acuminate above, and obliquely produced backward, linear, coarctate, about as long as the spire. Peristome margined within or with an opaque ochrey thickening, inner lip arcuately projecting in the middle. Columella short, at the base with an abruptly truncate twisted projection. Length 8.5, diam. 2.5, aperture 4.12 mm. (Lowe, 1854).

Madeiran archipelago: Southern Deserta, very rare among plants and stones (Lowe, Wollaston).

Achatina producta LOWE, Ann. and Mag. Nat. Hist. (2 ser.), ix, p. 120 (Feb., 1852); P. Z. S., 1854, p. 202.—*Lovea p.*, WOLLASTON, Testac. Atlant., p. 261.

This species resembles *F. nitriiformis* and its allies by the forwardly descending lip and very narrow posterior part of the aperture, but it differs in having a thin outer lip, and the parietal wall is without calluses of any kind. The specimen illustrated, from the Wollaston collection, measures, length 7, diam. 2.4, aperture 4 mm. long. It may not be fully adult, for the outer lip has not the internal thickening mentioned by Lowe.

69. *F. IRIDESCENS* (Wollaston).

"Shell rather narrow, cylindric-subulate, fragile, subpellucid, with an iridescent luster; spire produced. Whorls a little convex, suture distinct, oblique. Aperture narrow, attenuate and obliquely produced backward above, wholly toothless. Peristome thin, acute, the right lip rather straightened; columella short, arcuate, somewhat twisted, somewhat expanded, but a little prominent at the base. Length scarcely 3 lines" (Wollaston).

Madeira: between Caniço and Sta. Cruz, on the stems of *Euphorbia* (Wollaston).

Lovea iridescens WOLL., Testacea Atlantica p. 262 (1878).

"The present *Lovea*, which appears to be quite distinct from every member of the group which was described by Mr. Lowe, belongs to exactly the same type as the South-Desertan *L. producta*, its rather narrow, subulate outline, oblique suture, fragile consistency, and perfectly edentate, backwardly (and obliquely) acuminate mouth being strongly suggestive of that species. Nevertheless specifically it is quite distinct—its smaller size, darker hue, and conspicuously iridescent surface, in conjunction with its slightly shorter and more attenuated spire, its rather less flattened volutions (the penultimate one of which is not elongate), its still thinner and more pellucid substance, and the fact of its columella being less twisted and not so prominent at the base, being more than enough to separate it immediately from *L. producta*" (Wollaston).

70. *F. TEREBELLA* (Lowe). Pl. 39, figs. 21, 22.

The shell is slender, fusiform-ovate, thin and somewhat transparent, though decidedly thicker than *F. gracilis*, corneous-brown with a white sutural band bordered by a gray line. Whorls $6\frac{1}{2}$, very flat, slowly increasing to the last, which descends more obliquely. Aperture subvertical, not calloused within the outer wall, half as long as the shell, piriform. The outer lip is thin but has a narrow white bordering callus; it is convex in the middle in profile view, retracted above. There is a moderately thick, smooth parietal callus. The short white columella is somewhat thickened, and appears nearly straight in front view, but viewed obliquely in the aperture a low but distinct spiral fold is seen above. Length 6.1, diam. 2.3, aperture 3 mm.

Porto Santo: In the higher mountains, especially Pico Branco.

Achatina terebella LOWE, Ann. Mag. N. H. (2 ser.), ix, p. 120 (Feb., 1852).—*A. gracilis* var. *terebella* LOWE, P. Z. S., 1854, p. 200.—*Lovea terebella* (with var. *subula*) WOLLASTON, Test. Atlant., p. 251. Not *Cochlicopa terebellum* Sowerby, 1844.—*Achatina lowei* PAIVA, Journ. de Conchyl., 1866, p. 339, pl. 11, f. 1; Moll. terr. et fluv. Ins. Maderensium, p. 108, pl. 2, f. 7.

This species seems well distinguished from *F. gracilis* by the constantly larger size, less fragile shell, and somewhat stronger columellar fold as seen obliquely in the mouth. It is a smaller species than *F. producta*, with less sinuous outer lip and wider aperture. Figured from a specimen from the Lowe-Wollaston collection.

Var. *subula* (Lowe). Pl. 39, figs. 17, 18, 19.

Shell smaller, relatively narrower and more acute, the upper part of the aperture narrower. Length 6, diam. 2, aperture 2.6 mm., or smaller, length 5 mm. Whorls 6-7.

Ilheo de Cima and Ilheo de Baixo, and on the neighboring Pico de Baixo on Porto Santo (*Wollaston*).

Achatina gracilis var. *subula* LOWE, P. Z. S., 1854, p. 200. Not *Achatina subula* Pfr., 1839.

Figured from Lowe-Wollaston collection examples. The name is preoccupied, but it is doubtful whether the form is worth another.

Var. *ventricosa* (Paiva).

"Shell more ample, very glossy." Ilheo de Fora, at the end of the Ponta de Sao Lourenço, Madeira, coll. by the Rev. R. Boog Watson.

Achatina gracilis var. *ventricosa* COSTELLA DE PAIVA, Monographia molluscorum terrestrium fluvialium lacustrium insularium Maderensium, p. 108 (1867).

An insufficiently defined form, placed by the Baron de Paiva next to *terebella*, which he treats as a variety of *gracilis*. It may be identical with the following.

Var. *laurentiana* n. var. Pl. 40, figs. 30, 31.

The shell resembles *terebella* but is thinner, with a narrower subsutural white band, less obliquely descending last whorl, and a longer, much narrower aperture, which in its acuminate posterior part and forwardly sloping lip resembles that of *F. producta*. The columella is more distinctly truncate at base than in *terebella*, and in oblique view in the mouth its weak spiral fold is lower down. The outer lip is perfectly thin at the edge, and in profile view it is more amply dilated forward. Length 6, diam. 2.1, length aperture 3.25 mm.; whorls 6.

Madeira: Ponta Sao Lourenço (M. Grabham .

Twenty-four living specimens collected by Mr. Grabham agree in differing from *F. terebella* as above indicated, and doubtless constitute a distinct race or species. It may, however, be what the Baron de Paiva attempted to define as *A. gracilis* var. *ventricosa*. There is also a possibility that *laurentiana* is what de Paiva alludes to as a more ample form of *A. leacociana*, from this very place—Sao Lourenço Point (Monogr. Moll. Mader., p. 106).

F. iridescens Woll. must be similar, but is described as conspicuously iridescent. No figure has been published, and the diameter and length of aperture are not given by Wollaston. I have therefore thought it well to suitably define and figure the form from Sao Lourenço, leaving its ultimate status to be determined when the characters of the several ill-defined forms mentioned above are ascertained.

71. *F. GRACILIS* (Lowe). Pl. 39, fig. 20; pl. 40, fig. 32.

"Shell long-obovate, slender, thin, glassy, glossy, smooth, imperforate. Spire subattenuate, obtuse, more than half the length of the shell. Whorls rather flattened, the suture rather obsolete. Aperture obovate, toothless, columella broadly expanded, slightly truncate, tapering into the thin, submarginate lip. Length 2, diam. 1 line, whorls 5" (Lowe).

Length 4, diam. 1.8 mm. (specimen).

Porto Santo: Common in some places in the mountains, type loc. Pico Branco; also in the Grand and Southern Desertas.

Helix gracilis LOWE, Trans. Cambr. Philos. Soc., iv, 1831, p. 61, pl. 6, f. 28.—*Achatina g.*, PFR., Monogr., ii, p. 284.—*A. g.*, var. *vitrea* LOWE, P. Z. S., 1854, p. 200.—*Glandina gracilis* ALBERS, Malac. Mader., p. 56, pl. 14, f. 24, 25.—*Lovea gracilis* WOLL., Test. Atlant., p. 250.

The name *vitrea* Lowe was applied to the typical form of *gracilis*, as distinguished from several forms which Lowe considered varieties.

I have copied on pl. 39, fig. 20, the figure of Albers, which, however, is not very good, being too conic and acute. A typical example from the Wollaston collection is drawn on plate

40, fig. 32. Wollaston remarks that "As thus limited, therefore, the *L. gracilis* may be known by its small size and somewhat slender outline, by its extremely thin, almost colorless, and transparent substance, and by its rather wide (or expanded), but nevertheless *simple* (or basally untruncate) arcuated columella. Although it has been found sparingly (as just stated) on the two Southern Desertas, it is a species which is more particularly characteristic of Porto Santo, where I have met with it in profusion, beneath stones, on the exposed mountain ridge which connects the Pico de Facho with the Pico do Castello. Mr. Lowe's original examples, however, were from the Pico Branco" (*Wollaston*).

Subgenus PYRGELLA Lowe.

Pyrgella LOWE, P. Z. S., 1854, p. 205, type and sole species *A. leacociana*.

Shell turrite-oblong, thin; aperture short, less than half the total length, ovate, the outer lip in profile very strongly arched forward, retracted above, not calloused inside; parietal wall smooth; columella slightly twisted. Type *F. leacociana*.

This form seems to be more closely related to *Cylichnidia* than to any other group, although it is without apertural lamellæ or callosities. The Pyrenean *Cryptazeca* has some resemblance to *Pyrgella*.

72. *F. LEACOCIANA* (Lowe). Pl. 39, figs. 26, 27.

The shell is very small, oblong-turrite, widest near the base, very thin and fragile, subtransparent, yellowish-corneous, glossy, with a very narrow gray subsutural margin edged below with a light line. The spire has slightly convex outlines and obtuse summit. Whorls $5\frac{1}{2}$, slowly widening to the last which descends more rapidly. The aperture is small, piriform, very narrow above. Outer lip thin, strongly arched forward in the middle, deeply excised or retracted to the suture above. Columella rather wide, projecting into the aperture, truncate at base. Length 3.7, diam. 1.6, length of aperture 1.5 mm.

Madeira: Near Funchal in the Ribeira de Joao Gomes (type loc.), and near the Levada da Senhora do Bom Successo; in the

north near Porto Moniz; also at Santa Cruz; under stones, very rare.

Achatina leacociana LOWE, Ann. Mag. Nat. Hist. (2 ser.), ix, p. 119 (1852); P. Z. S., 1854, p. 205.—PAIVA Mon. Moll. Mader., p. 105.—PFR., Monogr., iii, 511.—*Lovea leacockiana* WOLLASTON, Test. Atlant., p. 249.

The small, fragile shell is shaped much like *C. lubrica*, from which it differs conspicuously by the wide truncate columella and the strongly arcuate very thin outer lip. It has been reported by Paiva from Sao Lourenço Point; but is not present in the collection made there by Mr. Grabham, who found specimens at Santa Cruz.

Subgenus CYLICHNIDIA Lowe.

Cylichnidia LOWE, Ann. Mag. N. H. (2), ix, 1852, p. 119 (for *A. leacociana* and *cylichna*; *A. ovuliformis* also mentioned); P. Z. S. 1854, p. 206, type *A. ovuliformis*.

Shell short, elliptical-ovate, somewhat pupiform, composed of few whorls, 4 to 5; aperture piriform, contracted by a strong parietal lamella and sometimes supraparietal and palatal folds; columella plicate or horizontally truncate at base. Type *F. ovuliformis*.

This group is remarkable for its apertural plicæ and lamellæ. *F. cylichna*, a decidedly phylogerontic form as shown by the abnormal development of the parietal callus, is now extinct. In its apertural armature *Cylichnidia* apparently shows relationship to *Azeca* and to *Calaxis*.

73. *F. OVULIFORMIS* (Lowe). Pl. 39, fig. 23; pl. 40, figs. 36, 37.

"Shell narrowly elliptical somewhat pupiform, of equal width at the two ends, short, glossy, smooth. Spire very obtuse, half the length of the shell. Whorls slightly convex, somewhat swollen; suture distinct. Aperture obovate, narrow, biplicate, one fold transverse, abrupt and prominent, situated midway between the columella and angle of the lip, the other at the columella, more obsolete, oblique. Columella expanded, thin, twisted, obliquely truncate. Length 2, diam. 1 line, whorls 4" (*Lowe*).

Porto Santo: Abundant in some places in the higher mountains, chiefly at the summit of Pico de Facho, the type locality.

Helix ovuliformis LOWE, Trans. Cambr. Philos. Soc., iv, 1831, p. 61, pl. 6, f. 27.—*Achatina o.* LOWE, P. Z. S., 1854, p. 206.—PFR., Monogr., ii, 278.—*Lovea ovuliformis* WOLLASTON, Test. Atlant., p. 263, with var. *pseudopsis*, p. 264.

This seems to be a variable little species. The typical form, as described and figured by Lowe, has no supraparietal nodule, and the parietal callus is thin. Wollaston defines a var. *pseudopsis* characterized by having a "corneous sphincter [parietal cord] across its ultimate volution, commencing near the angle of the outer lip and merging (as in the case of the *L. cylichna*, where, however, it is much more expressed), in an unbroken curve, into the columella.

This callosity is usually very faint, and often (as in the type from which Mr. Lowe's original diagnosis was compiled) obsolete; but it is sometimes exceedingly apparent, and occasionally indeed so much developed that it shapes out at its commencement (near to the angle of the lip) an abrupt and almost dentiform subvertical process. Examples thus furnished might well be supposed, at first sight, to belong to a separate species, did they not pass into the opposite extreme of form by the closest intermediate gradations. I would, therefore, record this phasis of the shell as the var. *B. pseudopsis*" (Wollaston).

In one of the specimens before me (pl. 39, fig. 23) the parietal callus is very thin, but it bears a stout supraparietal callous nodule. There are 4 whorls, the second disproportionately wide. Length 3.6, diam. 1.75, length of aperture 1.75 mm.

Other examples (pl. 40, fig. 37) have the same shape, $4\frac{1}{2}$ whorls, but the entering parietal lamella stands alone on the thin, transparent, parietal callus. Length 3.7, diam. 1.7, aperture 1.75 mm. This is the typical *ovuliformis*.

Another form (pl. 40, fig. 36) has the spire more conic and elongate, the last whorl more slender; whorls $4\frac{1}{2}$; aperture as in the preceding. Length 3.8, diam. 1.7, length of aperture, 1.7 mm.

The columella in this species resembles that of *F. leacociana*. Half-grown shells have the parietal lamella well developed.

74. *F. CYLICHNA* (Lowe). Pl. 39, figs. 28, 29.

The small, thin shell is cylindric-oblong, about equally blunt at the two ends; smooth. The spire is wide, with convex outlines and a very obtuse summit. Whorls 4, but slightly convex, rapidly widening. Aperture piriform, acuminate above. The outer lip is thin, in profile sloping forward from the suture down, broadly rounded below the middle. The parietal callus forms a thick elevated cord except near the posterior or upper angle, and in the middle bears a very strong horizontal entering parietal lamella. Within the outer lip there is a strong compressed palatal fold at its lower third, and two minute tubercular marginal tubercles at the upper third. The columella projects as a prominent horizontal fold above the deep basal truncation. Length 2.7, diam. 1.1, aperture 1.4 mm.

Madeira: Caniçal (Lowe, type loc.) and Point Sao Lourenço (Grabham), abundant as a fossil. Not found living.

Achatina cylichna LOWE, Ann. Mag. Nat. Hist. (2 ser.), ix, p. 119 (Feb., 1852); P. Z. S., 1854, p. 206.—*Lovea cylichna* WOLLASTON, Test. Atlant., p. 264.

Distinct from all other species by its pupiform shape, the strong lower palatal plica and prominent parietal and columellar lamellæ. *F. ovuliformis* is the only closely related species.

Glandina cylichna Albers, Malacographia Maderensis, p. 84, pl. 17, f. 19, 20, very imperfectly represents this species. Bourguignat has gravely copied Albers' wretched figure, inserting it as "*Cæcilianella cylichna*" in his monograph of *Cæcilianella*, Revue et Mag. de Zoölogie, 1856, p. 429, pl. 12, f. 26.

Genus CRYPTAZECA de Folin et Berillon.

Cryptazeca DE FOLIN ET BERILLON, Bull. Soc. Borda, 1876, p. 1.

Shell ovoid, thin, of 6 whorls; aperture half the total length, ovate-piriform; no parietal lamella; outer lip thin, arched forward; columella short, *abruptly truncate* at the base.

Animal (of *C. monodonta*) grayish-ruddy above, the top of the head nearly black, below whitish; upper tentacles strong, sub-inflated at their apices, blackish, with a moderate sized ocular dot; lower tentacles widely separated and shorter. Head pro-

boscidiform, grooved above. Posterior end abruptly, strongly truncate, the truncation with a pit, the outlet of mucous glands; beyond this it terminates in a rather long tail. Pedal disk thick, separated from the body by a deep longitudinal furrow which defines a pedal margin one-third the height of the body; margin transversely sulcate, and crenulated by the sulci below. Two feeble longitudinal grooves divide the flanks into three reticulated zones. The mantle extends over the parietal callus. The movements of the animal are very lively.

Type, *C. monodonta*.

This peculiar form of the Basque country is isolated among continental groups. It is more closely related to those of Madeira. *Cryptazeca* may well be a relict form of the Iberian early tertiary islands, and genetically connected with the Madeiran groups. Anatomically it resembles *Ferussacia*, the jaw and radula being similar, but the mantle is apparently not reflexed over the outer lip of the shell around the aperture, as it is to a greater or less extent in *Ferussacia*.

By its abruptly truncate columella, *Cryptazeca* differs from *Ferussacia* proper, but the same feature occurs in some Madeiran species, in *Calaxis*, and in *Azeca*.

C. MONODONTA (de Folin et Berillon). Pl. 48, fig. 22.

Shell minute, subelliptical, wider below; apex obtuse; longitudinally very minutely and regularly striate, translucent, glossy, pale fulvous. Whorls 5 or 6, slowly increasing, nearly flat, slightly convex, joined by a linear, hardly impressed suture; the last whorl larger, two-thirds the total length. Aperture long, subpiriform, narrow above; outer lip arcuate, arched forward and slightly bent inward below, with a feeble callus or thickening most pronounced at the inflection; it is reddish-brown. Columellar margin separating into three lines below: the lower line running out in a rather prominent tooth, the intermediate line following the columella and disappearing above, the outer line curving gracefully, continuing the peristome across the parietal wall. Length 4, diam. 1.6 mm. (*Folin*).

S. W. France: Basses Pyrenees, near Cambo, on the bank of

a little stream flowing into the Nive; living in moss and dead leaves, sometimes under stones, in damp places (*Folin*). Western Pyrenees in the Basque country, environs of Bayonne (Granger). N. E. Spain, on the grassy mountain-slopes surrounding the Concha d'Orduna, rare (Kobelt).

Cryptazeca monodonta de FOLIN et BERILLON, Contrib. Faune Française, iii, 1876, p. 1, pl. 3, f. 4, 5, in Bull. Soc. Borda, p. 199, pl. 1, f. 1.—de FOLIN, Le Naturaliste, xiii, 1891, pp. 264–267, figs. 1–9 (anatomy), with var. *hyalina*, p. 267, and *subcylindrica*, p. 267. Anatomy by J. Barrois, p. 266, figs. 1–9.—*Azeca monodonta* GRANGER, Actes Soc. Linn., Bordeaux, lii, 1897, p. 248.—KOBELT, Iconogr. n. F., vii, p. 37, pl. 188, f. 1201.—BARROIS, Revue des Sci. Nat. de l'Ouest, 1892, ii, p. 331, figs. 1–9, anatomy (repeated from Le Naturaliste, 1891).—*Azeca m.*, WESTERLUND, Fauna, iii, p. 150.

I have been unable to consult the original description of this species, published in 1876, and hence have depended upon the other authorities cited above, the description being taken from de Folin's account in *Le Naturaliste*. The figures are from Kobelt.

Var. *hyalina* Folin. Similar to *monodonta*, but the shell is without the warm coloration; instead of being a fine tawny color it is crystalline; the outer margin is also less dark and only roseate.

Var. *subcylindrica* Folin. Shell narrower, more lengthened, subcylindric, whorls often 7, nearly flat; usually subhyaline or hyaline. Length 4.3, diam. 1.3 mm., whereas the typical form of *monodonta* measures 3.6 x 1.5 mm.

Genus CALAXIS Bourguignat.

Calaxis BOURGUIGNAT, in LETOURNEUX et BOURGUIGNAT, Prodrome de la Malacologie terr. et fluv. de la Tunisie, 1887, p. 114, for *hierosolymarum*, *rothi*, *sauleyi* and *moussoniana*.—*Elastomophora* WESTERLUND Fauna Paläarct. Reg. Binnenconch. iii, p. 152, 1887, (as a synonym of *Calaxis*, no type mentioned).—*Tornatelloides* PFEIFFER, in part, Monographia Heliceorum Viventium viii, p. 299, for *F. achatinoides*, *fraseri*, *microxia*, *diodonta*, *hierosolymarum*, *rothi*, *moussoniana*, *unidentata*, *ovuli-*

formis (1877).—*Tornatellinoides* PFR., in part, Nomenclator Hel. Viv., 1878, p. 338, for most of the same species.

Shell cylindric-oblong or lanceolate with conic spire, thin, whitish, glassy, composed of 6 to 9 flattened whorls, the last large. Aperture vertical, lanceolate, very narrow above, with a deep rounded sinus below the projecting, lamellar, strongly truncate columella; a strong parietal lamella is usually present, and generally a weak palatal plica opposite it, but in some species these are wanting.

Type *F. hierosolymarum*. Distribution, Syria, Palestine, lower Egypt. These shells differ from *Pegea* by the peculiar Achatinoid columella and glassy texture. Kobelt seems disposed to rank the group as a distinct genus, as Bourguignat has done.

Pfeiffer's group *Tornatelloides* (later emended to *Tornatellinoides*) contained representatives of several genera. His first species, *achatinoides*, which I take to be the type (following Tryon, Struct. and Syst. Conch. iii, p. 62) is a Gambier Island shell apparently belonging to the *Tornatellina* group.

1. *F. hierosolymarum* Roth. Pl. 45, figs. 29, 32.

Shell subfusiform, vitreous, pellucid, glossy, with a conic, acute spire. Whorls 8, flat, the last cylindric, shorter than the spire. Columella subhorizontally, shortly truncate, callous, with a lamella in the upper part. Aperture elliptical, rounded basally, the upper angle very acute; parietal wall bearing a strong acute spiral lamella, which continues inward to the apex; palatal wall delicately uniplicate; right margin arcuate, acute. Length 4 to 8, diam. 1.5 to 2, aperture 2 to 3 mm. (*Roth*).

Palestine: Type locality near Jerusalem on the road to Bethlehem, under an overhanging rock.

Tornatellina hierosolymarum ROTH, Malak. Bl. i, 1855, p. 39, pl. 1, f. 8, 9.—PFR., Monogr., iv, 652; vi, 260.—MOUSSON, Coquilles terr. et fluv. recueillies par Roth en Palestine, 1861, p. 51, with var. *discrepans*, p. 52.—*Ferussacia* h., BGT., Rev. et Mag. Zool., 1864, p. 208, pl. 18, f. 1-4; Moll. nouv. litig. etc., iv, p. 126, pl. 19, f. 1-4.—*Calaxis* h., KOBELT, Iconogr., vii, p. 17, pl. 184, f. 1164.

This is a somewhat variable species, in which a second parietal tooth is sometimes developed, sometimes only indicated, or wholly wanting. The palatal plica is sometimes stronger, sometimes weaker, and occasionally doubled. Westerlund and Kobelt agree that the several forms described by Bourguignat, as well as the var. *discrepans* of Mousson, are merely forms of a single species. I give below the alleged differential characters and copies of the original figures.

Var. *discrepans* Mousson.

A little larger, whorls slightly convex, the last shorter, sub-angular above and below, not over one-third the total length; columella strongly armed, lamella smaller. A single example found among the typical form, leaves it doubtful whether this is a good variety or merely an exceptional variation.

Var. *rothi* Bourguignat. Pl. 45, figs. 30.

Differs from *F. hierosolymarum* by the more lanceolate shell, less ventricose, the more regular increase of the whorls, the spire a little longer, the parietal lamella especially more compressed, more projecting, less thick, by the columella terminating in a lamella which becomes nearly flat at the base, while in *hierosolymarum* the columella is simply twisted by a lamelliform fold which descends obliquely; finally by having two palatal plicæ within the outer lip. Length 7, diam. 2.25 mm., whorls 8.

Jerusalem (Roth).

Ferussacia rothi BGT., Malac. Algerie, ii, p. 31; Rev. et Mag. Zool., 1864, p. 193, pl. 18, f. 13-16; Moll. nouv. litig. etc., iv, p. 108, pl. 19, f. 13-16.

Var. *moussoniana* Bourguignat. Pl. 45, fig. 33.

Distinguished from *F. rothi* by the more lanceolate shell, a little more globular at the base, by the more dilated basal part of the aperture; the columella armed with two lamelliform folds, an upper and a lower, while in *rothi* there is only one. Length 7, diam. 2 mm., Whorls 8 to 9.

Around Jerusalem, Bethlehem, etc., very abundant under stones and rocks.

F. moussoniana BGT., Malac. Algerie, ii, p. 31 (Jan., 1864);

Revue et Mag. de Zool., 1864, p. 195, pl. 18, f. 5-8; Moll. nouv. litig., iv, p. 111, pl. 19, f. 5-8.

Var. *cypria* Kobelt. Pl. 45, fig. 31.

The suture between the last two whorls descends more rapidly than between preceding whorls; the parietal lamella stands somewhat higher than in *C. rothi*; no trace of a palatal plica. Length somewhat over 7.5 mm. (*Kobelt*).

Levkara, Cyprus (*Rolle*).

Calaxis rothi var. *cypria* Kob., Iconographie, Supplement-Band, p. 59.—*C. hierosolymarum* v. *cypria* Kob., t. c., pl. 20, f. 6, 7, 1896.

2. *C. SAULCYI* (Bourguignat). Pl. 45, fig. 34.

Shell acuminate-oblong, fragile, smooth, glassy, transparent. Spire acuminate, the apex a little obtuse. Whorls 8, nearly flat or slightly convex, regularly and slowly increasing, separated by a paler, superficial, duplicated suture; the last whorl half the total length. Aperture long, contracted, very narrow, bilamellate; palatal lamella in fully adult shells small, the other lamella terminating the columella. Outer margin strongly arched forward; margins joined by a callus. Length 6.5, diam. 2 mm. (*Bgt.*).

Syria: Environs of Sayda, very rare.

Ferussacia saulcyi Ber., Malac. Algerie, ii, p. 31; Rev. et Mag. Zool., 1864, p. 196, pl. 18, f. 9-12; Moll. nouv. litig., etc., iv, p. 113, pl. 19, f. 9-12.

Distinguished from the other species by the excessively contracted aperture and very short, almost wanting columella. Nothing is said of a parietal lamella; it is apparently wanting.

3. *C. UNIDENTATA* (Jickeli). Pl. 45, fig. 35.

The cylindric-fusiform shell is thin, translucent, smooth, glassy, white. Spire long-conic, the apex obtuse; whorls 6, flattened, regularly increasing, separated by a duplicated suture, the last whorl descending in front and longer than the spire. Aperture oblong, narrowed and acutely angular above, dilated towards the base. The columellar margin is covered with a thin callus and carries in the middle of its length a fold, below which

it is concave. The columella is obliquely truncate at base. The outer margin of the peristome is thin and acute. Length 4.5, diam. 1.5, aperture 2.5 mm. (*Jickeli*).

Egypt: near the Mahmudi canal at Alexandria, one dead shell in a rice field.

Ferussacia unidentata JICK., Malak. Bl. xx, 1872, p. 103; Fauna der Land-und Süßwasser-Mollusken Nord-Ost-Afrika's, in Nova Acta Acad. Caes.-Leop. Carol. Germanicæ Nat. Cur. vol. 37, p. 132, pl. 5, f. 20, 1875.—KOBELT, Iconogr. vii, p. 36.

Differs from *C. hierosolymarum* by the longer last whorl and narrower aperture. This species, known from a single example has been referred to *Calaxis* with doubt by Westerlund and Kobelt, but from Jickeli's remarks and comparison with the type of *Calaxis hierosolymarum*, it seems to belong strictly to the same group.

Genus DIGONIAxis Jousseaume.

Digoniaxis JOUSS., Bull. Soc. Malacologique de France, vi, 1889, p. 348, for *D. bourguignati*.

Shell long, turrite, composed of numerous slowly and regularly increasing whorls. Aperture about one-third the total length, semioval, the outer lip simple, arching forward; columella vertical, strongly bilamellate; internal axis spirally sinuous.

Type *D. bourguignati*. Distribution, Aden, Ceylon.

A genus of uncertain position, probably near *Calaxis*, as M. Jousseaume believes, but differing in the longer spire and the strong development of a spiral lamella superposed upon the upper part of the columella. There are no parietal or palatal lamellæ. The internal axis, as seen through the shell, is strongly spiral, the upper lamella penetrating deeply, according to Jousseaume. It is possible, however, that the spiral condition is due to the basal lamella.

1. *D. BOURGUIGNATI* Jousseaume. Pl. 50, figs. 1, 2.

Shell imperforate, elongate-acuminate, very thin, translucent, vitrinoid, very glossy, polished, or under a very strong lens delicately striatulate. Spire long, acute at the apex. Whorls 10, convex, slowly increasing, separated by a deep suture; the

penult. and last whorls biangular, one angle above, the other below, flatly roof-shaped around the suture. Last whorl slightly over one-third the total length, biangular, the upper angle bounding the roof-like subsutural belt, the other below at the periphery, flat between the angles from the beginning. Aperture suboblique, irregularly subovate, the outer margin arching forward. Columella bilamellate, the lamellæ acute, thin, the upper one stronger and coiled around the axis. Peristome fragile, unexpanded and acute. Length 9, diam. 2.5, alt. aperture 3 mm. (*Jouss.*).

Mahala, between Aden and Steamer Point, on the beach.

Digonixaxis bourguignati JOUSS., Bull. de la Société Malac. de France, vi, p. 348 (1889); vii, 1890, p. 101, pl. 3, f. 1-3.

2. *D. CINGALENSIS* (Benson). Vol. xviii, pl. 4, fig. 18.

Shell subrimate, subulate-turritid, slender, solid, polished, striatulate, decussated with minute, very close undulating spiral striæ. Spire elongate, noticeably tapering above, apex unknown. Suture slightly impressed, irregular. Whorls remaining 11 (the apical ones wanting), flattened, the last whorl rounded basally. Aperture suboblique, emarginate-elliptical; peristome unexpanded, calloused within at the upper angle; outer margin arcuate above, basal margin thickened, columellar margin calloused, a little expanded, subreflexed, provided above with an oblique solid spiral fold. Length 14, diam. 3, aperture 3×1.5 mm. (*Bens.*).

Ceylon: Weelgamooewe, Matelle (Layard).

Spiraxis cingalensis BENS., Ann. and Mag. N. H. (3 ser.), xi, p. 91, 1863.—PFR., Monogr., vi, p. 191.—HANL. & THEOB., Conch. Indica, pl. 79, f. 1.

A *Syrnola*-like shell, differing from *Tortaxis* by the spiral plait on the upper part of the columella. Its solidity causes me to place it in *Digonixaxis* with some doubt, especially since it belongs to a different fauna. Known to me by description and figure only.

Genus AZECA 'Leach Turton.'

Includes *Azeca*, *Hypnophila*, *Gomphroa*, etc.

Oblong or ovate-fusiform *Ferussacidæ*, with the aperture short,

ovate, less narrow above than in *Ferussacia*, and with a tendency to be toothed, either near the upper end of the parietal callus, in the middle of the parietal wall, or on all margins; columella abruptly truncate at the base at all stages of growth.

The penis has a long club-shaped appendix; radula with about 20, 1, 20 teeth, the laterals bicuspid.

Type *A. menkeana goodalli*. Distribution, central and southern Europe and north Africa.

In the present condition of our knowledge of the soft anatomy of these snails, I see no sufficient cause for separating *Hypnophila* and *Azeca* generically. *Cryptazeca* also seems similar by the compact shape and truncate columella of the shell, but the absence of any apertural teeth or calluses whatever may be held to sufficiently characterize it as a distinct genus; moreover, the soft anatomy of *Cryptazeca* is that of *Ferussacia*, so far as known. The modern subgenera of *Azeca* are evidently relics of an old stock, which seems to have passed its acme.

Subgenera of *Azeca*.

- a. Aperture conspicuously toothed or lamellate on both outer and inner margins. *Azeca*, s. str., species 1, 2.
- a'. No teeth or lamellæ in outer lip.
 - b. Parietal callus thickened with the edge calloused near the posterior angle; columella truncate, at least in oblique view. Subgenus *Hypnophila*, sp. 3 to 14.
 - b'. Parietal callus thin; not toothed; columella scarcely truncate. Subgenus *Gomphroa*, sp. 15, 16.

Subgenus AZECA, s. str.

Azeca ("adopted from Dr. Leach") TURTON, Manual of the land and fresh-water shells of the British Islands, pp. 6, 68, "type *Turbo tridens* Montagu."—LEACH, Synops. Moll. Great Britain, edit. Gray, 1852, p. 88, for *A. matoni* Leach=*A. m. goodalli*.—*Azecastrum* BOURGUIGNAT, Aménités Malac., ii, p. 87 (1858), type *A. tridens*.—PFR., Monographia Heliceorum Viventium, iii, 521, etc., in part.—KNIGHT, Journal of Conch., ix, p. 275 (derivation of name *Azeca*).—*Odontalus* PARKEYSS, Systemat. Verzeich. Oesterreich Land- u. Fluss-Conch., in

Berichte Mittheil. Freude Naturwiss. Wien, vi, 1850, p. 99, for *O. tridens* Drap.—*Azeqa* Leach, GRAY, P. Z. S., 1847, p. 175.

Shell long-ovate or subfusiform, smooth and glossy as is usual in the family, composed of 6 to 8 nearly flat whorls, the last swollen behind the outer and basal lips. Aperture ovate, the outer lip excised or retracted in its upper third, then contracted with blunt or slightly expanded edge, the lip-ends connected by a callous cord across the parietal wall, rising into a small triangular tooth near the upper angle of the mouth. Parietal wall bearing a deeply entering parietal lamella, a small tubercle above its outer end, and a small lamella at the root of the columella. Columella with a vertical white lamina, and a basal tooth or stout lamella. Outer lip with a marginal tooth and sometimes lower palatal and deeply placed denticles. The exterior coloration, and soft parts of *Azeqa* have been described by Jeffreys, Moquin-Tandon and others, but no mention is made of pedal grooves or a tail-pore. The soft anatomy, except jaw and teeth, has not been described.

Type *A. menkeana goodalli*. Distribution, central Europe and England.

Azeqa contains a single well-marked recent species, with a number of subspecies or local races, of which only one, *A. m. goodalli*, has been adequately worked out. Some half dozen others, diagnosed by French "*nouvelle ecole*" authors, require further investigation. *A. elongata* Taylor seems to be a remarkably distinct species, yet it is known by only two specimens, and may possibly be an abnormal form. According to Knight, the name *Azeqa* was taken from a town of the tribe of Judah. It appears that Leach used various other oriental geographic names for genera of shells without much regard for their fitness.

There are several tertiary species beginning with the middle eocene *A. boettgeri*. The earliest are allied to modern forms, and throw but little light on the genesis of the genus, which must have arisen very early. In the miocene a group of species with small teeth appeared (*A. monocraspedon* and its allies), representing either a collateral phylum or a branch with simplified apertures. The fossil species known to me are as follows:

Azece boettgeri Andreae, Neues Jahrb. für Min. u. Geol., 1882, ii, p. 293. Middle Eocene of Buchweiler, Alsace. Related to *A. menkeana*.

Azece peneckeii Andreae, Mittheil. Roemer Mus., No. 18, p. 15 (= *A. boettgeri* Pen., not Andreae). Upper Oligocene of Reuen, Steyermark.

Azece monocraspedon Slavic, Archiv f. d. Naturw. Landesdurchf. v. Böhmen, i, 1869, p. 264, pl. 6, f. 16, 17.—Sandberger, t. c., p. 434. Tuhoric, Bohemia, Lower Miocene.

Azece vitrea Klika, Die tert. Land- und Süßwasser-Conch. Nordwest. Böhmen, 1891, p. 75, fig. 72. Lower Miocene, Tuhoric, Bohemia.

Azece pumila Slavic, t. c., 1869.—Klika, Tert. Land- und Süßwasser-Conch Nordwest. Böhmen, 1891, p. 73, fig. 70.

Azece loxostoma Klein (*Achatina l.*, Klein, Wurttemb. Jahresh., ix, p. 214, pl. 5, f. 12), Sandberger, t. c., p. 596, pl. 29, f. 17. Upper Miocene, Morsingen, etc., Germany.

Azece frechi Andreae, Mittheilungen aus der Roemer Museum, Hildesheim, no. 18, 1902, p. 15, fig. 7. Miocene, Oppeln, Silesia.

Azece baudoni Michaud, Journ. de Conchyl., 1862, p. 69, pl. 4, f. 8, Hauterive. The aperture seems to be tridentate, somewhat as in *A. elongata* Taylor, and *A. monocraspedon* Slavic.

Azece loryi Michaud, t. c., p. 70, pl. 4, f. 7, Hauterive, is very similar to *A. menkeana*, but it has a higher crest behind the outer lip. It is probably not in the direct ancestral line of any living form, being somewhat more specialized.

Azece miliolum Paladilhe, Revue des Sci. Nat., Montpellier, ii, 1873, p. 47, pl. 2, f. 13-15. Pliocene, Montpellier. Seems to stand near *A. baudoni*.

1. A. MENKEANA (C. Pfeiffer). Pl. 46, figs. 1, 2.

The shell is cylindric-fusiform, brownish-corneous, somewhat transparent, very smooth and glossy, faintly marked with growth-lines. Spire convexly conic, the apex obtuse. Whorls 7, nearly flat, the last tapering towards the rounded base; suture distinct, but slightly impressed. The aperture is ovate, vertical, obstructed by numerous teeth: on the parietal wall

there is a narrow callous ledge bordering the parietal callus, extending to the base, and above rising into a triangular tooth near the upper angle; a high median deeply entering parietal lamella, the outer end of which, in well developed specimens, curves downward and again inward, making a semicircular or horseshoe-shaped callous ridge (see fig. 5). There is a small supraparietal tubercle above the outer end of the parietal lamella. The columella has an obtuse, deeply placed callous fold, and a horizontal basal lamella. The outer lip is thick, its upper third excised, and below the excision the margin is contracted; above the middle it bears a prominent marginal tooth, with a more deeply placed tubercle below it. Within the back of the last whorl there are two tubercular plicæ, the lower one larger. Length 6.5, diam. 2.7 mm.

Central Europe: Germany, France; type locality Pyrmont, Germany.

Carychium menkeanum C. PFEIFFER, Systematisches Anordnung u. Beschreib. Deutscher Land- und Süßwasser-Schnecken, p. 70, pl. 3, f. 42 (1821).—*Pupa menkeana* C. PFR., Naturgeschichte Deutscher Land- und Süßwasser-Mollusken, iii, p. 62 (1828).—*Bulimus menkeanus* MOQUIN-TANDON, Hist. Nat. Moll. terr. et fluv. de France, p. 302, pl. 22, f. 7-14, with varr. *nouletianus* and *crystallinus*.—*Azece menkeana* PILSBRY, Journal of Conchology, xii, April, 1908, p. 137.—*Odontalus tridens* Drap., PARREYSS, Syst. Verzeichniss, etc., p. 99 (1850).—*Achatina goodalli* ROSSMAESSLER, Iconographie, ii, p. 33, fig. 654.—*Azece tridens* Pult., PFEIFFER, Monographia Hel. Viv., ii, 276; iii, 522; iv, 645; vi, 255; viii, 311 (see for full references); Conchyl. Cab., *Bulimus*, p. 371, pl. 37, f. 27-30.

Pulteney supposed that this species was the *Turbo tridens* of Müller, an error which various authors detected independently, hence the multiplicity of names given it between 1821 and 1831. As a specific name *A. menkeana* is preferable, since it was well described and figured by C. Pfeiffer in 1821, while Férussac's name, *goodalli*, of the same date, was unaccompanied by description or figure, being based upon the accounts of Pulteney and Montagu.

Var. *mabilleana* Fagot. Pl. 46, figs. 7, 8, 9.

Similar to *menkeana* but larger, the spire longer; reddish-corneous. Whorls 8, very regularly and slowly increasing. Outer and basal lips very strongly contracted, preceded by a conspicuous ridge, palatal plicæ 2, the lower somewhat immersed as in *menkeana*, but there are no teeth within the back of the last whorl. Length 7 to 7.5, diam. 3 mm.

Southwestern France: Lourdes.

Azeca mabilleana FAGOT, Monogr. des espéc. Fr. Azeca, p. 6, in Bull. Soc. Scient. Pyr.-Or., xxii, 1876.

Figured from topotypes.

Var. *antiqua* 'Bgt.' Fagot. A Quaternary fossil from around Toulouse or Villa-franca (exact locality not given), resembling *mabilleana*, but with more fusiform spire and stouter folds, and with two teeth in the outer lip, one exactly opposite the parietal lamella, the other very deeply placed, punctiform. The dimensions are given as alt. 7 to 8, diam. $\frac{1}{2}$ mm., an evident error. (*Azeca antiqua* Bourguignat, FAGOT, Bulletin Société d'Hist. Nat. de Toulouse, xiii, 1879, p. 299.)

Var. *alzenensis* Saint-Simon.

Differs from *menkeana* by its more reddish, very finely striate shell, the first whorls more swollen, the aperture piriform-rounded basally instead of being piriform-angular; by having a deeper sinus above in the outer lip; peristome and sutures of a more ferruginous red, and by some differences in the teeth: the upper parietal tooth is further from the parietal lamella; the columellar folds are more curved, the upper internal one having nearly the shape of the columellar tooth of *Pupa partioti*. Finally, the small denticles deep in the throat are rounded and smaller than in *menkeana*. Length 6, diam. 2.5 mm., whorls 7 to 8.

Pyrenees: in rock crevices of the northern slope of Mt. Alzen, near the Bastide de Sérou (Ariège), at an elevation of 700 meters; also at Lourdes.

Azeca tridens var. *alzenensis* SAINT-SIMON, Annales de Malacologie, i, p. 24 (1870?), with description of dentition, ganglia and appendix.

Moquin-Tandon's description and figures of *A. tridens* are said to be from specimens of this variety. According to Saint-Simon the appendix is long with club-like end, similar to that figured for *Chondrus quadridens* on pl. 22, f. 3, of Moquin-Tandon's Mollusques de France. The jaw is composed of about 20 wide plaits. Its ends are pointed, as in *Zonites lucidus*. Radula with 80 rows of 14, 8, 1, 8, 14 teeth, the marginals with 4, laterals with 2 cusps. Central teeth very small.

Var. GOODALLI (Férussac). Pl. 46, figs. 3, 4, 5.

The obesely fusiform shell is comparatively shorter than in *menkeana*, composed of $6\frac{1}{2}$ to 7 whorls, the last swollen and whitish behind the outer and basal lip margins, the outer lip being excised and rather thin in the upper third, blunt and narrowly expanded below. Parietal lamella, supraparietal denticle and cord along the edge of the parietal callus about as in *A. menkeana*. Columella strongly dentate at base, and with a broad white vertical lamella above, scarcely visible except in oblique view. Outer lip having a stout marginal tooth opposite the parietal lamella, but usually no lower palatal fold, and there are no deep seated internal teeth within the outer wall.

Length 5.5 to 6, diam. 2.5 mm.

England, type loc. "by the river Stour." Southern France.

Turbo tridens PULTENEY Catalogues of the birds, shells and some of the more rare plants of Dorsetshire, p. 46, in Hutchin's History of Dorset, (1799). Not *Turbo tridens* Gmelin 1791 (*Helix tridens* Müller).—DACOSTA, Testacea Brit. p. 338, pl. 11, fig. 2 (1803).—MONTAGU, Testacea Britannica, 1803, p. 338, pl. 11, fig. 2.—*Azece tridens* FORBES & HANLEY, Hist. Brit. Moll. iv, p. 128, pl. 125, f. 9.—*Helix goodalli* FERUSSAC, Tableau Systematique la Famille des Limaçons, p. 71, no. 492ter. (1821), no description; based upon *Turbo tridens* of Pulteney and Montagu. *Carychium politum* Jeffreys, Trans. Linnean Society of London xvi, p. 365 (1829).—*Pupa britannica* KENYON, The Magazine of Natural History etc., (Louden's), i, p. 427 (1829).—*Azece matoni* "Leach, Mollusc. p. 122, t. 8, f. 8," TURTON, Manual of the land and fresh-water shells of the British Islands, p. 68. fig. 52 (1831).—*Azece nouletiana* DUPUY,

Cat. extramar. Gall. test. 1849, no 31; His. nat. Moll. terr. et d'eau douce France, p. 338, pl. 15, f. 12.—*Pupa goodaill* DUPUY, Essai Moll. Dept. Gers. p. 42.

Var. *cristallina* (Dupuy). Pl. 46, fig. 3.

Shell of a transparent white resembling that of *Helix cristallina*; color of the animal pure white, the tentacles and back somewhat gray (*Dupuy*). The shell has one tooth on the right margin, thickened below, with a sinus in the upper part, columellar margin with 4 teeth, two large and two small. Two of these teeth continue as milk-white lamellæ in the interior of the shell. None of the specimens have an inner tooth in the right margin. Length 6 to 7, diam. 2 or 3 mm.

French Pyrenees: Dept. Gers, at Bivès and Blousson-Sérian.

Pupa goodaill var. *cristallina* [*sic*] DUPUY, Essai sur les Mollusques terr. et fluv. du Département du Gers, p. 43 (1843).

This name was evidently based on albino examples of what was described later by Dupuy as *A. nouletiana*. Similarly colorless examples occur at Ilkley (fig. 3) and probably other places in England.

Var. *trigonostoma* Fagot. Shell rather *ventricose*, oblong-ovate, reddish-corneous. Whorls 7, scarcely convex, rather rapidly increasing, the last large, compressed below and somewhat angular. Aperture lunate-triangular, with the parietal and columellar lamellæ as in *mabilleana*, and with a small marginal tooth exactly opposite the parietal lamella; no palatal teeth; outer margin *weakly* excised above. Length 6, diam. 3 mm. (*Westerlund*).

France: Luchon.

Azeca trigonostoma FAGOT, Monogr. Azeca, p. 7, in Bull. Soc. Scient. Pyr.-Or., xxii, 1876.—*Cionella t.*, WESTERLUND, Fauna, p. 149.

Var. *bourguignati* Fagot. Shell *lengthened-oblong*, fragile, corneous. Whorls $8\frac{1}{2}$, flattened, slowly increasing, the last scarcely larger, *hardly one-third the total length*, contracted below. Aperture obliquely piriform, nearly triangular, very narrow and pointed above on the right, with the parietal and columellar lamellæ as in *mabilleana* but weaker; *without teeth*

in the outer lip or throat. Outer lip but little excised above. Length 7.5, diam. 3 mm. (Westerlund).

France: Bouilly, Aube.

Azeca b., FAGOT, Monogr. *Azeca* p. 8, in Bull. Soc. Scient. Pyr.-Or., xxii, 1876.—*Cionella b.*, WESTERL. Fauna, p. 149.

2. *A. ELONGATA* Taylor. Pl. 46, fig. 6.

"Shell of an elongate form, composed of about $9\frac{1}{2}$ slightly convex whorls, increasing gradually in size, of a yellowish-brown or chestnut colour, smooth and glossy, with very indistinct striae; periphery rounded, spire produced and blunt at the apex, suture impressed, mouth pyriform, acutely angled posteriorly with a broad marginal callosity margined on the penultimate whorl and columella by a raised thread-like rib, and furnished with a strong and somewhat posteriorly inclined denticle on the middle of the outer margin, an anteriorly convex, simple pointed denticle at the base of the columella, and on the penultimate whorl there is a small denticle about midway between the outer lip and the columella. Length 9, breadth 2.5, aperture 2.5 mm. long." (Taylor.)

England: Ingleton, Yorkshire, type loc.; North Wales.

Azeca elongata TAYLOR, The Naturalist, London, March, 1897, p. 75, fig. in text; copied in Journal of Malacology vi, 1897, p. 15, fig. 1A.

Based upon two specimens.

"Compared with *Azeca tridens* this form may be immediately recognised by its elongate shape, which markedly contrasts with the almost exactly pupaeform shape of the typical *A. tridens*. There are $9\frac{1}{2}$ whorls instead of seven only, and they also increase more slowly in size, the last whorl being comparatively smaller than in Pulteney's species. The aperture is more broadly expanded than in *A. tridens*, and not nearly so compressed posteriorly, and its armature is strikingly distinct, for while the denticle upon the outer lip is stronger and the tooth at base of columella though of similar size is different in character, there would seem to be a total absence of the peculiar winding columellar lamella which is so conspicuous a feature in *A. tridens*, and has been sup-

posed to represent the clausilium of the Clausiliæ, and which I figured at p. 128 of my monograph. Its rounded basal termination can be seen just above the columellar denticle in the figure of *A. tridens*. On the penultimate whorl there is merely a slight denticle to represent the twin spirally winding lamellæ present in its ally." (Taylor.)

Subgenus HYPNOPHILA Bourguignat.

Hypnophila BGT., Aménités Malacologiques ii, p. 88 (Revue et Mag. de Zool. 1858), for *A. pupæformis*, *zacynthia*, *emiliana*, *cylindræa*, *incerta*, *psathyrolena*.

Shell oblong, with small oblique aperture; parietal callus thick at the edge, rising into a triangular tooth near the posterior angle; columella more or less truncate at base; aperture otherwise toothless. Type *A. pupæformis*.

A Mediterranean group, with species in Greece, Dalmatia, Italy, Sicily and northwestern Africa. Whether it is anatomically like *Azece* has not been determined.

Dalmatian and Grecian Group.

3. *A. PUPÆFORMIS* Cantraine. Pl. 47, fig. 9.

Shell ovate-elliptical, imperforate, thin, smooth, subtranslucent, yellowish corneous. Spire conic with somewhat convex sides, the apex but slightly obtuse. Whorls 7 to 8, very slightly convex, regularly increasing, separated by a suture which is margined on the lower whorls; last whorl two-fifths the total length, measured behind, flattened behind the lip, rounded basally. Columella short, subvertical, scarcely arcuate, and in oblique view appears truncate at the base. Aperture slightly oblique, ovate, slightly compressed at the base. Peristome unexpanded, rather obtuse; the margins joined by a thread-like callus, which follows the outer edge of the columella to the base, and above, near the insertion of the outer lip, is impressed and bears a glossy white tubercle. Outer lip is somewhat thickened internally in the middle, and somewhat straightened below, so that the aperture appears rather pointed there. Length 7, diam. 3 mm. (Kobelt).

Dalmatia: Zara and Spalatro.

Bulimus pupæformis CANTRAINE, Bull. Soc. Roy. Bruxelles ii, 1836, p. 380; Malac. Medit. et Lit. p. 137, pl. 5, f. 11.—*Azece pupæformis* PFR., Symbolæ etc. ii, p. 136; Monogr. iii, 522; iv, 646; vi, 255; viii, 313.—BOURGUIGNAT, Revue et Mag. de Zool. 1858, p. 543, pl. 18, f. 4-6; Aménités Malacol. ii, p. 102, pl. 14, f. 4-6.—*Mastus canthraini* BECK, Index Moll. p. 73 (1837).—*Achatina dentiens* ROSSMAESSLER, Iconographie ii, p. 33, sp. 655.—*Columna dentiens* VILLA, Dispositio Syst. p. 20.—*Ferussacia (Hypnophila) pupæformis* KOBELT, Iconographie (n. F.) vii, p. 20, pl. 185, f. 1167 a, b.

This rather rare Dalmatian species is closely related to the Grecian forms described below.

4. *A. ZACYNTHIA* Roth. Pl. 47, fig. 1, 2, 3, 5.

Shell ovate-subcylindric, corneous fulvous, pellucid; whorls 6, the last equal in length to the penultimate, entirely flat, joined by a hair-like suture. Spire obtuse. Aperture oblique, subcircular; columella dentate-truncate deep within; peristome subreflexed, rather thick, white, margins connected by a white callus which ascends the left margin and abruptly ends, leaving a notch at the upper angle of the aperture. Length 5.25, width 2.5, alt. apert. 1.5, width 1 mm. (*Roth*).

Greece: Zante (type loc.), and Corfu.

Azece zacynthia ROTH, Malak. Bl. ii, 1855, p. 39, pl. 1, f. 10, 11.—PFR., Monogr. iv, 646; vi, 256.—*A. zacinthia* BGT., Amén. Mal. ii, p. 104, pl. 14, f. 13, 14 (copied from Roth).—*Cionella zakynthia* HESSE, Jahrb. D. M. Ges. ix, 1882, p. 330 (Corfu).—WESTERLUND, Fauna iii, p. 151.—*Ferussacia (Hypnophila) zacynthia* KOBELT, Iconogr. n. F. vii, p. 21, f. 1168.

More cylindric than *A. pupæformis*, with fewer whorls, smaller and rounder aperture, subreflexed peristome, etc. Numerous examples are before me from Corfu, collected by Conemenos, three being figured on my plate. The size varies from 5 x 2.4 mm. with 6¼ whorls, to 5.8 x 2.5 mm. with fully 7 whorls. The peristome is continued as a raised ledge along the columellar border, and is cord-like across the parietal wall, terminating above in a subtriangular denticle such as the

allied Grecian species have, and also *Azece menkeana*. In oblique view in the mouth the columella appears very broad, and distinctly truncate at base. In old and well developed specimens the lower two-thirds of the outer lip is very narrowly but distinctly expanded, and the upper third of the lip is markedly thinner. The whorl contracts more or less perceptibly to the mouth, but less than in *A. cyclothyra*.

The following form, *B. politus*, is *probably* identical with *zacynthia* or one of the closely allied forms. Its exact identity probably cannot now be established and hence the name, while prior to any other for a Grecian species, cannot be used.

Bulimus politus Parreyss. "A species of Greece, which with much resemblance in shape to *B. lubricus*, has the columella deeply truncate, and by rights should have place among the Achatinæ of Lamarck, or the Columnæ of Perry." (*Porro*, *Malacologia terrestre e fluviale della Province Comasca*, Milano, 1838, p. 54, pl. 2, f. 8c).

This form was thus briefly described and figured by Carlo Porro from specimens given him by Parreyss. I have translated his account above, and copied his figure on pl. 47, fig. 4. So far as I know this is the only information published. Westerlund (*Fauna* iii, p. 147) places it under *C. lubrica* as a variety, a course he surely could not have taken had he seen the original account in Porro. His diagnosis applies to something entirely different.

5. *A. CYCLOTHYRA* Boettger. Pl. 47, figs. 7, 8.

Intermediate between *C. zacynthia* Roth and *C. integra* Mouss., but larger than either. Differs from the first by the more oblong-ovate shell, less distinctly rimate, $6\frac{1}{2}$ whorls, the aperture smaller for the size of the shell, nearly circular, not subtriangular, the base contracted and exactly rounded; truncation of the columella distinct, but less dentiform. It differs from *C. integra* by the more ventricose shell, not in the least cylindric, the more curved base of the aperture, and the much more distinct columellar truncation. Alt. 6 to 6.25, diam. 3 mm. (*Bttg.*)

Greece: Santameri, Achaia (Conemenos).

Cochlicopa (Hypnophila) cyclothyra BTG., Nachrbl. d. D. Malak. Ges. xvii, Aug. 1885, p. 121.

Dr. Boettger remarks that *C. pupiformis* Cantraine does not occur in Greece. All three known Grecian species contrast with the Sicilian and Dalmatian forms by the more obtuse summit of the shell. Each of the Grecian species is yet known from a single place, and no transition forms have appeared up to this time.

The figures are drawn from specimens received from Conemenos. The whorl contracts more strongly to the aperture than any *A. zacynthia* I have seen, and the lip-edge, while blunt, is not perceptibly expanded. The columellar margin is built up level with the outer lip by a white callous ridge. The columella in oblique view is very wide and obliquely truncate at the base.

6. *A. INTEGRA* MOUSSON. Pl. 47, fig. 6.

Shell subrimate, cylindric-ovate, pale corneous-fulvous, glossy, pellucid. Spire with obtuse summit, suture flat, marked with a whitish line. Whorls $7\frac{1}{2}$, flat, the earliest a little convex, the last slightly exceeding one-fourth the total length. Aperture small, obliquely semicircular, columella straight, not truncate or toothed. Peristome continuous, white, thread-like, very narrowly reflexed, the right margin evenly arched, columellar margin strongly raised, subcallous, parietal margin thread-like, abruptly terminating in a long tooth below the insertion of the outer lip. Length 5.5, diam. 2.33 mm.

Island of Cephalonia (Schlaefli), everywhere under stones among herbage. Also Corfu (Broemme).

Azeca integra MOUSS., Coq. terr. et fluv. recueillies dans l'Orient par M. le Dr. Alex. Schlaefli, in Vierteljahrsschrift der Naturforschenden Gesellschaft in Zurich, iv, 1859, p. 32.—PFR. Monogr. vi, 255.—*Ferussacia (Hypnophila) integra* MOUSS., KOBELT, Iconographie n. F. vii, p. 21, pl. 185, f. 1169.

It approaches *A. pupæformis* Cantraine, but differs essentially. It is smaller, more cylindric, the aperture less long, *columella not truncate or toothed*. The columellar margin

is strongly raised. The original description is given above. The figure is a copy of Kobelt's figure of a specimen from Corfu.

Italian and Sicilian Group.

7. A. CYLINDRACEA (Calcara). Pl. 47, figs. 10, 11, 12.

Shell imperforate cylindric-turrite, smooth, thin, glossy, pellucid, yellowish-white. Spire slowly tapering, passing into a short cone at the summit. Suture scarcely impressed, absolutely margined. Whorls 7, flattened, the upper regularly increasing, the lower a little more obliquely descending, last whorl hardly one-third the total length, a little compressed basally. Columella straightened, tapering to the base, hardly truncate. Aperture vertical, semioval; peristome simple, the margins subparallel, joined by a very thin callus; right margin unexpanded, columellar margin a little reflexed, appressed, forming an angle with the parietal wall. Length 7, diam. 2 mm. (*Kobelt*).

Sicily: near Palermo (Benoit, Monts.); Ponte di Corleone (Calcara, type loc.).

Bulimus cylindraceus CALCARA, Monografie dei Generi Clausilia e Bulimo, 1840, p. 33, no. 8; Moll. di Palermo p. 31, fig. 11; Moll. di Sicilia p. 25, pl. 3, f. 11.—PFR., Monogr. ii, p. 161 (not iii, 653, according to Bgt.).—*Azecca* c., BGT., Aménités Malac. ii, p. 106, pl. 14, f. 7-9.—*Achatina* c., BENOIT, Illustr. Test. estramarini della Sicilia p. 233, pl. 5, f. 30.—*Ferussacia (Hypnophila) cylindracea* KOBELT, Iconographie n. F. vii, p. 23, pl. 185, f. 1173.

There is some diversity in the published figures of this form. Bourguignat, who states that his figures were from an example originally from Calcara, figures a narrower, more cylindric form than Kobelt, measuring 6 x 1.75 mm., apert. 2 x 1 mm., whorls 6½. His figures are copied on my plate 47, figs. 11, 12. Calcara gives the dimensions 3 x ½ lines, whorls 5. Kobelt's figures, copied on pl. 47, figs. 10, represent a more conic form.

8. *A. EMILIANA* 'Benoit' Bgt. Pl. 47, figs. 13, 14.

Shell cylindric, glossy, pellucid, smooth, corneous; spire conic, the apex rather obtuse. Whorls $7\frac{1}{2}$, flat, parted by a slightly impressed margined suture, the last whorl about one-fourth the total length. Aperture slightly oblique, half round; peristome unexpanded, simple; right margin a little thickened in the middle; columellar margin appressed to the simple columella, and bordered with a white thread-like callus; margins united by a weak parietal callus, which bears a thread-like tubercle near the insertion of the outer lip. Length 9, diam. 2, alt. of aperture 1.75 mm. (Bgt.).

Ægadian Is., off the west coast of Sicily: Island of Favignana, chiefly at the Grotta del Consiglio (Benoit); I. Maretime (Kobelt, and coll. A. N. S.)

Azece emiliana (*Bulimus emilianus* Benoit MSS.), BOURGUIGNAT, Revue et Magazin de Zoologie 1858, pl. 18, f. 1-3; 1859, p. 17; Aménités Malac. ii, p. 105, pl. 14, f. 1-3.—PFR. Monogr. vi, 256.—BENOIT, Nuovo Catalogo della Conch. terr. e fluv. della Sicilia, 1881, p. 82.—*Achatina emiliana* BENOIT, Illustr. Test. Sicilia iv, 1862, p. 234, pl. 5, f. 29.—*Ferussacia* (*Hypnophila*) *emiliana* KOBELT, Iconogr. n. F. vii, p. 23, f. 1172.

This species differs from *A. cylindracea* by its greater size, slightly swollen form, the reddish color of fresh examples, convex whorls, deeper suture, and the slightly wider, less vertical aperture, etc. Benoit gives the dimensions as 8×3 mm. My figures are from examples received from Benoit, 7.2×2.5 mm., with $6\frac{3}{4}$ whorls. The aperture is moderately oblique. The outer lip is thin and straight in its upper third, below which it is noticeably contracted, white, and thickened within. It is continued up the columella in a raised ledge, whence a white cord passes across the parietal wall, and is thickened into a triangular tooth near the upper angle of the aperture. Between this tooth and the insertion of the outer lip there is a deep and very narrow sinus. The columella is nearly straight, and is weakly truncate obliquely at the base.

9. *A. INCERTA* 'Benoit' Bgt. Pl. 47, figs. 15, 16.

Shell cylindric-oblong, fragile, glossy, pellucid, smooth, crystalline-corneous, the apex rather obtuse. Whorls 7, a little convex, separated by an impressed, margined suture, the last whorl one third the total length. Aperture semi-oblong, almost vertical; peristome simple, acute, not thickened, the outer margin simple; columellar margin with a straight white thread-like callus; margins joined by a thin callus with a thread-like tubercle near the insertion of the outer lip. Length 5, diam. 1.25, aperture 1.75 x 1 mm. (*Bgt.*).

Island of Lipari, in the district called Renella at monte della fossa. (*Ben.*)

Azeca incerta (*Bulimus incertus* Benoit MSS.) BGT., Revue et Mag. de Zool. 1858, pl. 18, f. 15-17; 1859, p. 19; Aménités Malac. ii, p. 108, pl. 14, f. 15-17.—PFR., Monogr. vi, 257.—*Achatina incerta* BENOIT, Illustr. test. Sicil. 1862, p. 232, pl. 5, f. 31.—*Ferussacia* (*Hypnophila*) *incerta* KOBELT, Iconogr. n. F. vii, p. 22, f. 1171.—*Cionella* (*Zua*) *incerta* WESTERL., Fauna iii, p. 148.

This species differs from *A. cylindracea* by the smaller, more glossy shell, more translucent, the suture more distinct, whorls more convex, etc. Description and figure from Bourguignat.

10. *A. SILVICULA* Benoit.

Shell imperforate, cylindric, smooth, translucent, composed of 8 slightly convex whorls separated by a superficial suture; apex obtuse. Aperture long-ovate, rather upright; peristome obtuse; columellar margin with a strong callus not tuberculate. Length 7, diam. 3 mm. (*Benoit*).

Sicily: Madonie (*Benoit*).

Azeca silvicula BEN., Nuovo Catalogo Conch. terr. e fluv. Sicilia, 1881, p. 82.—*Cionella silvicola* Ben., WESTERLUND, Fauna iii, p. 151.

Closely related to *A. emiliana*, but it differs by having more whorls which are more convex, by the strong callus of the columellar margin and the want of a tubercle on the

parietal margin. Not figured, and known by the original description only.

11. *A. DOHRNI* Paulucci. Pl. 48, fig. 18.

Shell cylindric, slender, glossy, lightly striatulate, pellucid-corneous. Spire conic, the apex mamillate. Whorls 7, nearly flat, separated by an impressed, margined suture; the last whorl one-third the total length, not descending at the aperture. Aperture semi-oblong, nearly vertical; peristome unexpanded, simple, the right margin a little thickened in the middle, columellar margin simple, straight; margins joined by a callus. Length 6, diam. 1.75 mm. (*Paul.*).

Sardinia: Sassari (Dohrn).

Azeca dohrni PAUL., Bull. Soc. Malac. Italiana viii, 1882, p. 271, pl. 8, f. 1.—*Ferussacia (Hypnophila) dohrni* KOBELT, Iconogr. n. F. vii, fig. 1175.

12. *A. ETRUSCA* Paulucci. Pl. 48, fig. 17.

Shell cylindric, thin, glossy, smooth, pellucid-corneous; spire conic, the apex obtuse; whorls 8, a little convex, the last one-fourth the total length, not descending at the aperture; suture impressed, margined. Peristome slightly reflexed; columellar margin subarcuate, somewhat calloused, a little reflexed; margins joined by a strong callus, bearing a thread-like tubercle near the insertion of the outer lip. Length 5.66, diam. 2 mm. (*Paul.*).

Italy: Monte Argentario, Tuscany.

Azeca etrusca PAUL., Bull. della Societa Malacologica Italiana xii, 1886, p. 36, pl. 2, f. 5.

North African Group.

13. *A. PSATHYROLENA* Bourguignat. Pl. 48, figs. 19.

Shell cylindric, glossy, very smooth, pellucid-crystalline; spire conic, apex mamillate. Whorls 7, flat, separated by an impressed, margined suture, the last scarcely one-third the total length, descending at the aperture. Aperture very oblique, semioval; peristome simple, acute, not thickened; outer lip sinuated in the middle; columellar margin straight, ap-

pressed in a whitish thread-like callus over the simple columella; margins joined, the callus with a thread-like whitish tubercle at the insertion of the outer lip. Length 6, diam. 1.5 mm., aperture 1.75 x .5 mm. (*Bgt.*).

Algeria: Forest of Edough, near Bone, type loc.; La Calle.

Azeca psathyrolena BGT., Amén. Malac. ii, p. 109, pl. 14, f. 10-12 (1859); Malac. d'Algerie ii, p. 22, pl. 2, f. 45-47.—*F. (Hypnophila) p.*, KOBELT, Iconogr. n. F. vii, p. 22.

A little-known form, said by Bourguignat to inhabit Sicily also. It is distinguished by the mamillate apex, very oblique aperture, the strong descent of the last whorl to the aperture, and the crystalline appearance.

14. *A. MAROCCANA* (Mousson).

Shell imperforate, subcylindric, glossy, polished, translucent, entire, white-corneous. Spire slowly, convexly tapering, the apex rather large, somewhat obtuse, corneous; suture lightly impressed. Whorls 6, slightly compressed, the last two descending, last whorl about one-third the length, elongate rounded. Aperture nearly vertical, (at an angle of 85 degrees with the axis), semicircular. Peristome unexpanded, rather obtuse; margins joined by a thin parietal lamina, right margin circular; columellar and basal margins defective. Length 5.2, diam. 2.5 mm.

Marocco: Rerey Valley, on travertine.

Cionella (Azeca) maroccana MOUSSON, Malak. Bl. xxi, p. 154; Jahrbücher D. M. Ges. i, p. 94.

This form agrees with no species known to us. It differs from the Algerian *A. psathyrolena* Bgt. by the less conic, more cylindric, convexly increasing shell of 1 to 1½ whorls less, by the regularly rounded aperture, with a layer over the parietal margin which is thinner and retreats more in the aperture. Unfortunately the columella and basal margin are injured. (*Mouss.*).

Subgenus GOMPHROA Westerlund.

Gomphroa WESTERLUND, Jugoslavenska Akademija Znanosti i umjetnosti, cli, p. 114, 1903, for *Zua boissii* Dupuy.

This Pyrenean group of two or three very little known species differs from *Hypnophila* by the less solid shell with the columellar truncation scarcely developed, and the parietal callus thin, not toothed posteriorly. The exact relationship of *Gomphroa* to neighboring groups has not been worked out. Its subordination to *Azece* is provisional.

15. A. BOISSII (Dupuy). Pl. 48, fig. 20.

Shell long-cylindric, subrimate; aperture semi-rotund, subpiriform; peristome unexpanded, rather acute, slightly white-thickened within and opaque; margins unequal, joined by a distinct callus. Whorls 6 to 7, nearly flat, the last forming over half the shell's length; columella with the distinct indication of a truncation at base. It is corneous, transparent, whitish and very glossy. Length 6, diam. 1.5 mm. (*Dupuy*.)

French Pyrenees, especially the Pyrénées orientales and in the mountains around Toulon.

Zua boissii DUPUY Hist. Nat. Moll. terr. et d'eau douce France, p. 332, pl. 15, f. 9 (December, 1850).—*Azece* b., BOURGUIGNAT, Amén. Malac. ii, p. 187.—*Ferussacia* (*Hypnophila* ?) b., KOBELT, Iconogr. vii, p. 36, pl. 188, f. 1199 (copied from Dupuy).—*Cionella boissii* WESTERLUND, Fauna iii, p. 150.—*Zua boyssii* Dup., LOCARD, Coq. terr. de France, in Ann. Soc. d'Agriculture, Sci. et Industrie de Lyon, 1895, p. 136, fig. 341-2.—*Achatina lubrica* var. *a. fusiformis* Picard, 1840, MOQUIN TANDON.

A little-known species, very rare in collections, and not known to me by specimens. Moquin-Tandon identified *Achatina lubrica* var. *fusiformis* Picard as identical with *boissii* Dup., but I think erroneously. The two were described from opposite ends of France.

Var. *dupuyana* 'Bgt.' Fagot.

Glassy, very smooth, pale translucent-corneous, of 6 nearly flat whorls; more obese than *boissii*. Length 6.5, diam. 2 mm.

Pyrénées-orientales near La Preste, at la Rourède d'en Ribes, and along the Tech, up the river from the bridge, on the path to Costa Bona.

Azece dupuyana 'Bgt.,' FAGOT, Monogr. des esp. Française

d'Azecca p. 9 (1876).—DUPUY, Bull. Soc. d'hist nat. de Toulouse xiii, 1879, p. 49.

Considered by Dupuy as at most only a variety of *A. boissii*.

Var. *cyindrica* (Massot).

Shell smaller, more narrowly cylindric in shape, less swollen at the base, and more obtuse above; whorls almost flat, the suture less impressed; aperture smaller, subrectangular, more narrowly lengthened; peristome but little thickened, the shell itself thinner. Length 5, diam. 1.75 mm. (*Locard*).

Le mas d'Amont, near Coustouges, eastern Pyrenees.

Ferussacia cylindrica MASSOT, Enum. Moll. Pyrénées-Orientales 1872, p. 53.—*Zua cylindrica* Massot, LOCARD, Ann. Sci. d'Agricult. de Lyon (7 sér.), iii, 1895, p. 137.

16. *A. VASCONICA* Kobelt. Pl. 48, fig. 21.

Shell regularly elongate-ovate, very thin, glassy-hyaline; spire convexly conic, the apex rather obtuse. Whorls 6, a little convex, parted by an obsoletely margined suture, slowly and regularly increasing, the last whorl rounded, scarcely as long as the spire. Aperture irregularly ovate, lunate, subvertical, base receding; peristome very thin, the margins joined by a translucent callus, outer margin produced in the middle, columellar margin short, straightened, not truncate. Length 3, diam. 1 mm. (*Kobelt*).

N.-E. Spain: in the Basque country, on the grassy outliers of the depression (*concha*) of Orduna, with *Cryptazeca monodonta*. (*Kobelt*.)

Ferussacia (Hypnophila ?) vasconica KOBELT, Iconographie Land und Süsswasser Mollusken, neue Folge, vii, 1896, p. 37, pl. 188, f. 1200.

Half the size of *A. boissii*, relatively more obese, and quite transparent.

Genus COCHLICOPA 'Fér.' Risso.

Cochlicopa FERUSSAC (in part), Tabl. Syst., 1821, p. 50.—RISSE, Hist. Nat. Eur. Mérid. iv, 1826, p. 79, for *C. lubrica* only.

Cionella JEFFREYS, Trans. Linnean Soc. of London, xvi, 1829, p. 347, for *lubrica*, *acicula* and *elongata* (= *B. octonus* Brug.).

Zua Leach, in TURTON, Manual of the land and fresh-water Shells of the British Islands, 1831, p. 82, for *Zua lubrica*, in synonymy under *Bulimus lubricus*.—GRAY, in Turton, edit. 2, 1840, p. 187.—LEACH Synops. Moll. G. B., edit. Gray, 1852, p. 81, for *Z. lubrica*.

Styloides FITZINGER, in part, Systematisches Verzeichniss der im Erzherzogthume Oesterreich vorkommende Weichthiere, in Beyträge zur Landeskunde Oesterreichs, iii, 1833, p. 105, for *S. acicula* and *S. lubricus*.

Folliculus AGASSIZ MSS., CHARPENTIER, Catalogue des Mollusques terrestres et fluviatiles de la Suisse, Neue Denkschriften der allg. Schweizerischen Gesellschaft für die gesammten Naturwissenschaften (Nouveaux Mémoires de la Société Helvétique des Sciences Naturelles) i, 1837, p. 14, for *Bulimus lubricus* only.

Achatinella SCHLUETER, in part, Kurzgefasstes systematisches Verzeichniss meiner Conchyliensammlung, Halle, 1838, p. 8, for *acicula*, *folliculus*, *unilamellata* (Schlueter, not described), *lubricoides*, *lubrica*.

Hydastes PARREYSS, Systematisches Verzeichniss der im Erzherzogthume Oesterreich bis im Jahre 1849 aufgefundenen Land- und Fluss-Conchylien, in Berichte ueber die Mittheilungen von Freunden der Naturwissenschaften in Wien, gesammelt und herausgegeben von Wilhelm Haidinger, vi, 1850, p. 98, for *H. lubricus* Drap.

The shell is oblong-conic or oblong-cylindric, imperforate, smooth and glossy, composed of 5 to 7 slightly convex whorls. Aperture small, ovate, nearly vertical, toothless. Outer and basal lips arcuate, obtuse, thickened within by a callous rim which is continuous to the upper insertion; columella short, concave or straightened, very slightly sinuate at the base; parietal callus very thin throughout.

The foot is rather short, without distinct parapodial grooves (in drowned alcoholic examples). Sole indistinctly tripartite. Kidney (page 213, fig. 2, κ), long-triangular,

passing directly into the ureter, which does not reach the collar. Heart much shorter than the kidney. The pulmonary vein has no large branches, but there is a fine capillary reticulation of the lung. At the left anterior angle there is a large glandular area of large cells (page 213, fig. 2, *gl.*).

Genitalia (page 213, fig. 3) with a long appendix inserted on the penis. This appendix is contracted near the middle, swollen again at the distal end. The spermetheca is oval on a rather long duct.

The buccal mass has the usual short form. Salivary glands short, compact, conerescent around the slender cesophagus. There is no crop. The jaw is arcuate, delicately and closely plaited vertically. The radula (fig. 1, *C. lubrica* from Philadelphia, Pa.) has 20,1,20 teeth. Centrals narrow, with a short middle cusp, no side cusps; laterals wide, with square basal plates and a large inner cusp (mesocone); outer cusp small, with a small cutting point only. There are 8 perfect laterals, the 9th or 10th tooth having the ectocone split. The marginals are low and wide, and have both cusps split, forming a pectinate edge of 4 to 6 denticles, decreasing towards the outer teeth. [Binney found distinct ectocones on the central tooth of an example from Maine; they have also been figured by Thomson.]

Type *C. lubrica* (Müller). Distribution, Holarctic realm: Europe, north Africa, Asia and North America. In European beds species have been found from the Eocene to the present time.

The foot in this genus seems to have no such pedal grooves as have been figured for *Ferussacia*, at least in the alcoholic examples available. There is certainly no caudal mucus pore visible. These characters together with the oblong shape of the shell, with a short, broadly ovate aperture, widely separate *Cochlicopa* from *Ferussacia*. The geological history of the two groups has doubtless been diverse; the distribution of *Cochlicopa* suggests that it may have been evolved on the Scandinavian land-mass of Mesozoic times, while *Ferussacia* was more southern, probably on the Iberian land-mass.

Fossil species referable to Cochlicopa.

Cionella formicina 'Rouis' Sandberger, Land und Süßwasser-Conch. der Vorwelt, p. 230, 1872, pl. 13, f. 18. Upper Eocene, Buxweiler.

Zua allixi Cossmann, Ann. Soc. Roy. Zool. et Malac. de Belgique, xli, 1906, p. 282, pl. 10, fig. 268 bis-1 (Dec., 1907). Sparnacien inférieur, Grauves. Probably not a *Cochlicopa*.

Cochlicopa headonensis 'Edw.' Newton & Harris (Proc. Malac. Soc. London i, p. 74, pl. 6, f. 4, 1894), from the Oligocene of Headon Hill, Isle of Wight, is a somewhat imperfect cast, apparently referable to this genus.

Achatina lubricella A. Braun, in Walchner, Geognosie, ii Aufl., 1850, p. 1136. Deshayes, An. s. Vert. Bassin Paris ii, p. 845, pl. 44, f. 22-24.—*Cionella lubricella* Sandberger, Vorwelt, p. 389. The name *lubricella* is preoccupied, but this form seems scarcely different from the following.

Cochlicopa subrimata Reuss, (*Achatina subrimata* Reuss, Paläontographica ii, p. 31, pl. 3, f. 9). Lower Miocene, Tucharie and Lipen, Bohemia.

Cochlicopa dormitzeri (Reuss), Klika, Tert. Land- u. Süßwasser-Conch. nordwest. Böhmen, p. 71, fig. 68. (*Achatina d.*, Reuss., *Cionella d.*, Klika). Lower Miocene, Tucharie, Bohemia.

Achatina splendens A. Braun in Walchner, Geognosie, p. 1136.—*Cionella splendens* Sandberger, Conchyl. Mainz. Tert. Beck, p. 392, pl. 35, f. 5. Miocene, Hochheim.

Cionella podolica Lomnicki, Verh. k. k. Geol. Reichsanst. 1885, p. 422. Wyczolki.

Zua lavissima Michaud, Journ. de Conchyl. 1862, p. 67, pl. 4, f. 9. Hauterive (Drome).

Zua brevis Michaud, l. c. p. 68, pl. 4, f. 10.

Ferussacia subcylindricoides Paladilhe, Revue des Sci. Nat., Montpellier, ii, 1873, p. 45, pl. 2, f. 4-6. Pliocene, Montpellier.

Férussac's subgenus *Cochlicopa* was a miscellaneous assortment of achatinoid snails, comprising *Halia priamus*, *Euglandina rosea*, *mulleri*; *Poiretia poireti*; *Oleacina glans*; *Variella leucozonias* and *dominicensis*; *Columna columna*; *Subu-*

lina octona; *Cacilioides acicula*; *Ferussacia folliculus* and *Cochlicopa lubrica*, besides a number of undescribed forms. Ferussac recognized two sections, Polyphemæ and Styloides; the latter term was used in a generic sense by Fitzinger, some years later, while Férussac's inclusion of *Columna* as a synonym, caused some Italian authors to use that name for *C. lubrica* and its allies. In 1826 Risso redefined *Cochlicopa*, retaining the single species *lubrica* therein, and formed new genera for various other of Ferussac's species. This fixed the significance of *Cochlicopa* several years before any other name was published for the group.

Dr. William Elfort Leach proposed the genus *Zua* in a work on the shells of Great Britain, in course of printing at the time of his death in 1820, but not finally published until 1852. Meantime Turton had mentioned "*Zua lubrica* Leach" in his synonymy of *Bulimus lubricus* (Manual Shells Brit. Is., 1831, p. 82), and Dr. Gray had introduced the genus in his edition of Turton's Manual, 1840, p. 187. Various writers have adopted *Zua* as a genus, erroneously dating it 1820. Its appearance in a published work dates from 1831.

1. *C. LUBRICA* (Müller). Pl. 49, figs. 33, 34, 35.

Shell oblong, the spire gradually tapering to an obtuse apex; thin, smooth, yellowish corneous, subtransparent and very glossy. Whorls $5\frac{1}{2}$ to 6, moderately convex. Aperture subvertical, ovate, toothless; outer lip evenly arcuate, obtuse, bordered with yellow or reddish outside, having a narrow smooth and continuous callous rib within. Columella somewhat straightened, calloused, often very indistinctly excised at the junction with the basal lip. Parietal callus thin, translucent.

Length 6.2, diam. 2.7, length aperture 2.5 mm., whorls 6 (Fig. 33, Middlesex).

Length 6.8, diam. 2.6, length aperture 2.7 mm., whorls $5\frac{1}{2}$ (Fig. 35, Gilbert White's estate, Selbourne).

America: Point Barrow, Alaska, south in the Rocky Mountains to the Mexican boundary; eastward south to Washington, D. C. and Missouri, with varieties in the Southern

Alleghanies, as far as northern Alabama. Also reported from—Venezuela, probably imported.

Atlantic Islands: Madeira; Sta. Maria, S. Miguel and Fayal, Azores.

Europe, etc.: Iceland; all Europe, south to Portugal and the Caucasus; Tunis, Algeria and Morocco.

Asia: Batum, Transcaucasia; Siberia, Barnaul, Tomsk, sources of the Uderei, on the rivers Kaja, Ida, at Irkutsk; middle Amur near the mouth of the Sungari, and lower Amur at Maji; Kamtchatka at Petropavlosk, Avacha Bay (Dall, Middendorff, Schrenck). Iskardo, Thibet (Benson). China at Bo-hua-shan, near Peking, and in many places in the province Gan-su (Mldff.). Japan: near Sapporo, Yesso (Rowland), with varieties in Sado, the Islands of Izu and Kikaiga-shima, Loochoo Is.

American references: *Bulimus lubricus* GLD., Invert. of Mass. 1841, p. 193, fig. 124.—BINNEY, Terrestr. Moll. ii, p. 283, pl. 52, f. 4.—*Cochlicopa lubrica* MÜLL., JOUSSEAUME, Mém. de la Soc. Zool. de France ii, 1889, p. 237 (Venezuela).—PILSBRY & JOHNSON, Nautilus 1898, p. 127.—Dall, Land and Freshwater Moll. of Alaska, p. 33.—*Cionella subcylindrica* W. G. BINNEY Land and Fresh-water shells of N. A. i, 1869, p. 224, figs. 381-385.—*Ferussacia subcyl.*, W. G. B., Terr. Moll. v, 1878, p. 187, pl. iv, fig. R (teeth); Man. Amer. Land Shells, 1885, p. 194, fig. 199-202 (jaw, teeth and shell).

Zua buddii DUPUY, Hist. Nat. Moll. terr. et d'eau douce qui vivent en France, p. 330, footnote (Jan. 1849), based upon *Zua lubrica* of American authors; type loc. United States.—*Bulimus lubricoides* STIMPSON shells of New England, 1851, p. 54, based upon *B. lubricus* Gld., Inv. Mass. p. 193, f. 124.—*Zua lubricoidea* Stimps., MORSE, Pulmonifera of Maine, 1864, p. 30, fig. 81 (jaw), 79 (shell), 84, pl. 10, f. 82 (teeth), (not *Achatina lubricoides* Pot. et Mich.).

European system:—*Helix lubrica* MÜLL., Hist. Verm. ii, p. 104 (1774).—*Bulimus lubricus* BRUG., Encycl. Méth i, p. 311.—*Achatina lubrica* ROSSMAESSLER, Iconogr. i, 1835, p. 88, fig. 43; "*A. intermedia* Ziegler aus Krain, und *A. lubricella* Z. aus Jedlersee bei Wien sind nur Varietäten unserer

Art'' [neither of them described].—PFR., Monogr. ii, 273; iii, 504.—*Ferussacia* L., PFR. Monogr. iv, 619; vi, 245; viii, 299 (see for references to European literature to 1877).—*Cionella lubrica* Müll., JEFFREYS, Trans. Linn. Soc. Lond xvi, 1829, p. 347.—BECK, Index Testac. 1837, p. 80.—BRAUN, Archiv für die naturkunde Liv- Ehst- und Kur-lands, 2d. Ser. ix, Dorpat 1884, p. 429, with *C. minima*, p. 431, and *C. columna*, p. 431 (Distribution in Russia).—WESTERLUND, Acta Soc. pro Fauna et Flora Fénica xiii, no. 7, 1896, pp. 81, 82, with var. *nitens* Kok., *ovata*, *viridula* Jeffer., *exigua* Mke., *nilssoni* Malm, *collina* Drt. (Dist. in northern Europe); Fauna iii, 1887, 147.—GOLDFUSS, Binnenmoll. Mittel-Deutschlands 1900, p. 181, with var. *columna* Cless., *exigua* Mke., *nitens* Kok., *sinistrorsa* nov., and *hyalina* Jeffer.—BABOR, Die Weichthiere des Böhmischen Plistocaen und Holocaen, in Archiv für Nat. Landesdurchforschung von Böhmen, xi, no. 5, p. 33-34, with var. *niteus* Koch = *nitens* Kok., fig. 11; var. *exigua* Mke.; var. *solumna* Cless. [sic] = *columna* Cless., p. 33, fig. 10.—*Achatina lubrica* MENKE, Synopsis Methodica Molluscorum etc., 1830, p. 29, with var. *grandis*, *communis* and *exigua* (all absolutely nude names).—*Buliminus lubricus* Müll., LEHMANN, Die Lebenden Schnecken u. Muscheln der umgeb. Stettins und in Pommern, 1873, p. 131, pl. 13, f. 44, (jaw, teeth and genitalia).—*Hydastes lubricus* Drap., PARREYSS, Syst. Verzeich., 1849, p. 98, with var. *nitidus* Kokeil and *lubricellus* Ziegler (names only).—*Cochlicopa lubrica* Müll. with var. *hyalina*, *lubricoides*, *viridula*, *fusca*, *ovata*, JEFFREYS, British Conch. i, 1862, p. 292, 293.—*Zua lubrica* LEACH Man. Moll. G. B., 1852, p. 188, pl. 6, f. 65.—CLESSIN, Nachr. D. Mal. Ges. 1908, p. 8, with var. *exigua* Mke., *curta* nov., *columella* Cless., *maxima* nov. (Danube at Regensburg).—GALLENSTEIN, Jahrb. d. Naturhist. Landes-Museums von Kärnten, xxvi (47te Jahrg.), 1900, p. 88, with forms *major* and *minima*.—*Helix subcylindrica* DILLWYN, Descript. Catal. ii, 1817, p. 952, not of Linnæus.—*Ferussacia subcylindrica* BOURGUIGNAT Malac. de l'Algerie ii, pp. 26, 35, pl. 3, f. 1-3, with var. *major* and *subviridula*. 1864.—*Bulimus (Cochlicopa) subcylindricus* L., MOQUIN-TANDON, Hist. Nat. Moll. terr. et

fluv. de France, ii, 1855, p. 304, pl. 22, f. 15-19 (jaw, genitalia, shell), with var. *fuscus*, *albinos*, *grandis*, *exiguus*, *colinus*, *fusiformis*.—*Férussacia cylindrica* Bourg., MORELET Journ. de Conchyl. xxviii, 1880, p. 59 (error for *subcylindrica*).—*Turbo glaber* DACOSTA, Testac. Brit. 1778, p. 87, pl. 5, f. 18.—*Glandina azorica* ALBERS, Zeitschr. f. Mal. 1852, p. 125.—*Achatina a.*, PFR., Monogr. iii, p. 504.—*A. lubrica* WOLLASTON, Test. Atlant. p. 49 (Azores Is.).

Asiatic references.—*Achatina lubrica* Müll., SCHRENCK, Reisen und Forsch. im Amurlande, ii, pp. 659, 939 (distribution in Siberia, etc.).—MIDDENDORFF, Reise in den äussersten norden u. osten Sibiriens ii, 1851, p. 308.—WOODWARD P. Z. S. 1856, 186 (Thibet).—*Cochlicopa lubrica* Mlldff., Annuaire Mus. Zool. Acad. Imp. Sci. St. Petersb. vi, 1901, p. 389.—RETOWSKY, Bericht ueber die Senckenb. Ges. 1889-90, p. 252 (Tchorok river at Batum, Transcaucasia).

The references to literature are selected from a great number of works consulted. It would be impracticable to cite here the innumerable works and local lists wherein the detailed distribution of the species in Europe and America is recorded. The earlier references have been industriously compiled by Pfeiffer, while later ones may be found chiefly in the conchological periodicals. I have aimed to include full information on all named varieties, as a rule quoting or translating in full the exact words of the original authors with figures where any exist. The names of races which seem to have subspecific value are printed in small capitals. Part of the other named forms are probably individual variations, part local forms or incipient races, generally of lower grade than American zoologists consider it useful to designate by name. Many of them are probably synonymous.

American specimens of *C. lubrica* are substantially like European. They vary from 5.5 to 6.5 mm. long, and there is also some variation in the shape. The larger, darkest shells seen are from the Eastern States, west to Indiana. Those of Arizona are smaller, very pale and thin. There are specimens in the collection of the academy from Greenland, presented by Dr. I. Lea, collector unknown. Both Dupuy and

Stimpson proposed to name the American *lubrica* as a separate species, neither giving any differences. Later, Morse attempted to find differential characters; but in large series the supposed differences disappear.

Two specimens of *S. lubrica* are reported by Dr. Jousseaume from Venezuela, collected by M. Simon, the well-known araneologist. One, a young shell, from Caracas, the other, adult, from Tovar. Dr. Jousseaume thinks that they may have been imported on plants.

1a. *C. LUBRICA MORSEANA* (Doherty). Pl. 49, fig. 42.

"Shell cylindrical, slender, thin, transparent, highly polished, reddish-brown, with slight, irregular lines of growth; whorls $5\frac{1}{2}$, flattened, the last nearly one-third the length; suture little impressed; apex very obtuse; aperture oblong-ovate, widest near base; peristome scarcely thickened; reddish; umbilicus closed; columella perpendicular, meeting base of peristome at something less than a right angle. Foot white, almost translucent; head grayish, with short tentacles. Length 7 mm. sometimes more; diam. 2 mm., aperture 2 mm. long." (Doherty.)

Ohio: Hamilton Co., Kentucky: Kenton Co., Tennessee: Blount Co., N. C.

Cionella (*Zua*) *morseana* DOHERTY, Quarterly Journal of Conchology i, 1878, p. 342, pl. 4, f. 2.—*Cochlicopa lubrica morseana* Doh., PILSBRY, Nautilus xi, p. 127.

This form resembles the var. *columna* Clessin of middle Europe. It differs from *C. lubrica* chiefly by its narrower shape, the whorls of the spire being longer, the last one shorter; moreover, the callous rim of the outer lip is much thinner and narrower in *morseana*. A specimen from Laurel Creek Gap, Blount Co., Tenn., is figured, pl. 49, fig. 42. It measures 7×2.2 mm., length of aperture 2.3 mm.; whorls $5\frac{1}{2}$, very rapidly increasing in width. The aperture is quite oblique.

The Cochlicopas of the higher ranges and peaks of the southern Alleghanies, from Roan Mt. southward, are closely related to *morseana*, yet may be separated as a mountain race, as follows.

1b. *C. LUBRICA* APPALACHICOLA n. v. Pl. 49, fig. 43.

Shell more cylindric than *C. lubrica*, less conic, *much thinner, transparent*, showing the pillar through; *pale greenish corneous*. Aperture much narrower than in *C. lubrica*, the lip but very lightly and narrowly thickened within. It differs from *C. l. morseana* in color and by having the aperture somewhat larger. Length 6.4, diam. 2.25, length aperture 2.3 mm.; whorls $5\frac{1}{2}$.

Southern Appalachian Mts.: Roan Mt., Mitchell Co., and Tuskegee Mt., Graham Co., North Carolina. Near Woodville, Jackson Co., Alabama, type loc.

A large specimen from Graham Co., N. C., is figured. It measures, length 7.1, diam. 2.3, aperture 2.9 mm., whorls $5\frac{2}{3}$.

This resembles various greenish forms named in Europe, yet is no doubt of independent genesis.

European forms.

Var. *fuscus* Moq. Shell brown, more or less dark. Marseilles, Montpellier (*Moquin-Tandon*, Hist. Nat. Moll. terr. et fluv. de France, ii, 1855, p. 304). Cf. also Jeffreys, Brit. Conch. i, 1862, p. 293, Guernsey.

Var. *albinos* Moq. Shell more or less whitish. Nantes, etc., (*Moq., t. c.*). Cf. also Baudon. "Dull white. Prairie d'Hondainville, Dép. de l'Oise, France." (Baudon, Mém. Soc. Académique d'Archeol., Sci. et Arts du Dép. de l'Oise, v, 1862, p. 194).

Var. *subviridula* Bgt. Shell resembling the type, but excessively transparent, and of a slightly greenish-vitreous tint. Constantine, Algeria (*Bourguignat*, 1864).

Var. *pachygastra* Stabile. Shell rather swollen, glossy, corneous-reddish. Ghisole near Pæsana, 540 metres elevation; Brossasco nr. Venasca, 600 meters. (*Bulimus subcylindricus* var. *pachygastra* Stabile, Mollusques terrestres Vivants du Piémont, Milan 1864, p. 72).

Var. *hyalina* Jeffreys. Shell greenish-white. Tawstock near Barnstable, England.

Var. *viridula* Jeffreys. Shell smaller and more slender, greenish-white. Dunboy, Co. Cork, Ireland.

Var. *ovata* Jeffreys. Shell much smaller and oval; spire shorter. Cardiff. (*Jeffreys*, Brit. Conch. i, 1862, p. 293).

Var. *olivea* Locard. Shell of medium size but often a little inflated, of an olive color. Quite common around Lyons in low and damp situations (*Locard*, Malac. Lyonnaise, 1877, p. 53; Variations Malacologiques i, 1880, p. 219).

Var. *grisea* Locard. Shell of moderate size and of a gray color; not very common, and chiefly in somewhat high places. (Variations Malac. p. 220).

Var. *opaca* Locard. Shell a little smaller than the type, completely compact [*"compacte"*]; of a clear gray color, very glossy; rare; environs of Lyons and Grenoble. (*L. c.* p. 220).

Var. *pallida* Locard. Shell usually smaller than the type, of a very pale fawn-corneous color; nearly transparent. High regions of Alpine countries. (*Locard*, Variations Malacologiques i, 1880, p. 220).

Var. *locardi* Pollonera. Differs from *Z. subcylindrica* by the less swollen shell, more lengthened, the whorls more slowly coiled, aperture smaller, the columella less subtruncate. Length 6.5, diam. 2.5 mm. Mt. Cenis at 2000 meters elevation. (*Poll.*).

Zua locardi POLLONERA, Molluschi terrestri viventi in Piemonte, in Atti della R. Acad. delle Science di Torino, xx, 1885, p. 693.

Var. *crassula* Fagot. Differs from *Ferussacia subcylindrica* and *exigua* by the thick shell relative to its small size, the whorls increasing more regularly, and better proportioned, the columella much calloused and oblique compared to the axis of the shell. Length 5.5, diam. 2 mm. Quaternary of l'Hers (Haute-Garonne); banks of the Lers at the *voutes* of Renneville.

Ferussacia crassula FAGOT, Moll. quatern. env. Toulouse et Villefranche, p. 23, in Bull. Soc. d'Hist. Nat. Toulouse, xiii, 1879, p. 300; Bull. Soc. Malac. France iii, 1886, p. 189.

"Differs from var. *exigua* Mke. by the more fusiform shell, the last whorl less swollen, rendering the aperture more contracted and more oblong." (*Fagot*).

Var. *litauica* Westerlund. Turrite, slender; whorls 6, convex, the last strongly convex; suture *strongly descending* towards the aperture. Length 5, diam. 1.5 mm. Lithuania (Westerl.). *Cionella lubrica* var. *litauica* WESTERL., Fauna iii, 1887, p. 148.

Var. *sinistrorsa* Goldfuss. Shell sinistral. Wormlitz near Halle, Thuringia (Goldfuss, 1900). Locard also has noted a sinistral specimen, *Variations Malacologiques* i, p. 220, 1880.

Var. *curta* Clessin. Shell short with broad base, the last whorl comprising only one-third the total length; length 5, diam. 2.3 mm. Danube at Regensburg. (Clessin, 1908).

1c. *C. LUBRICA COLUMNA* Clessin. Pl. 49, fig. 39.

Shell turrite, column-shaped, with obtuse, conic apex, smooth and glossy; with 6 very slowly increasing, not much overlapping, whorls, the suture very little impressed. Aperture long ovate, ending above in a very acute angle; peristome thickened, reddish. Length of the mouth one-third that of the shell; columella making a very weakly marked angle with the parietal wall. Length 5, diam. 1.8 mm. (Clessin).

Württemberg on the Jurassic limestone at Blaubeuern and Augsburg; Russia, between Wladimir and Nischney-Nowgorod in the Volga Valley.

Cochlicopa columna CLESS., Jahrb. D. Mal. Ges. ii, 1875, p. 41, pl. 2, f. 4; Deutsche Excursions-Mollusken-Fauna p. 183, fig. 102.—LICHERDOPOL, Buletinul Societatii de Sciinte din Bucuresci-Romania, xi, 1902, p. 355 (Bucarest).—F. (*Cionella*) *columna* PFR., Monogr. viii, 300.

Clessin further states that *C. columna* differs from *C. lubrica* by the longer spire, less convex whorls, smaller and narrower aperture. The whorls overlap less, so that the spire is more cylindric than conic. The aperture is more lateral than in *lubrica*. It resembles var. *maderensis*.

Dr. Babor's figures of pleistocene specimens (Die Weichthiere des Böhmischen Plistocaen und Holocaen, in Archiv f. Naturwiss. Landesdurchforschung von Böhmen, xi, 1903, no. 5, p. 33, figs. 10) do not seem to represent the real *columna*.

Var. *fusiformis* Picard. Shell as long as in typical *lubrica*, 6-7 mm., but much narrower, not at all swollen, all the whorls diminishing insensibly ("*Achatina lubrica* var. *a. H. fusiformis*" Picard, Histoire des Moll. terr. et fluv. qui vivent dans le département de la Somme, in Bull. de la Soc. Linéenne du nord de la France, i, 1840, p. 243). This form has not been adequately defined. It may be related to *columna* Cless., but no exact proportions are given by Picard, whose description is translated above. He does not give the exact locality in the Department of Somme.

1d. *C. LUBRICA MADERENSIS* (Lowe). Pl. 49, figs. 45, 46.

Shell narrower, more slender and cylindric than *C. lubrica*, the aperture comparatively shorter. The last whorl often ascends slightly to the aperture. The columella is concave above, slanting below and usually a trifle sinuate at base. The outer lip has a moderate or strong internal rim, and usually arches forward a little in the middle. Length 5.4, diam. 2.1 length of aperture 2 mm.; whorls $5\frac{1}{2}$.

Madeira: suburbs of Funchal, etc., generally distributed.

Helix lubrica var., LOWE Cambr. Phil. Soc. Trans. 1831, iv, 61, pl. 6, f. 29.—*Bulimus maderensis* LOWE, Ann. Mag. Nat. Hist. ix, 1852, p. 119.—*Achatina maderensis* PFR., Monogr. iii, 504; iv, 619; vi, 246.—*A. lubrica* var. *maderensis* WOLLASTON, Testacea Atlantica, p. 245, 1878.

This seems to be a well differentiated subspecies. In recent years, the ordinary European *C. lubrica* has also been imported to Madeira, where it exists in some localities. Fig. 45 is from an example from the suburbs of Funchal, 400 ft. elevation. Fig. 46 represents a small, thinner shell from Punta Sao Lourenco.

The form from the Azores Archipelago figured on pl. 49, fig. 44, is more robust than *maderensis*, scarcely to be distinguished from small *lubrica*. It has been described as *Glandina azorica* Albers, Zeitschrift für Malak. ix, 1852, p. 125, type loc. San Miguel. "Length 5.5, diam. 2.5, aperture 2.5 mm."

1e. *C. LUBRICA LUBRICELLA* 'Ziegler' Stabile. Pl. 49, figs. 36, 37, 38, 41.

Shell much smaller than *lubrica* and more cylindric, clear corneous or brownish-corneous. Peristome with a wide and rather thick internal rim. Whorls $5\frac{1}{2}$. Typical size, length 4.5 to 5, diam. 2 mm., but frequently smaller, 3.5×1.5 mm.

Russia: Transcaucasia; Caucasus; Riga (type loc. of var. *minima*); Duderhof near St. Petersburg; near Moscow; Podolia; Tegel near Berlin and many other places in Germany. France: Auxonne; Sathonay, (Rhône); Lyons, etc. etc.; Lugano, Switzerland, (type loc. of *lubricella*). Santa Cruz, Madeira (Grabham, 1902).

The figured specimens are from Tegel near Berlin, fig. 36, length 5 mm.; Auxonne; figs. 37, 38; France, fig. 41, length 4.5 mm.

Small forms of *C. lubrica* are of frequent occurrence in Europe, and probably in many cases are "physiological varieties"—their diminished stature due to unfavorable conditions, such as aridity, or the brevity of growing season at high elevations. As a general rule, in Central Europe *Cochlicopa* is small in dry, larger in moist situations. Hence these forms are probably to be looked upon as various local dwarfed races responding to local conditions, rather than as a homogeneous race. At present there seems to be no practicable course but to group all of the dwarf forms under *C. lubrica lubricella*. The original descriptions of the local forms follow.

C. var. lubricella 'Ziegler' Stabile. Alt. 5, diam. 2 mm. *C. lubrica* is two or three mm. larger. In both the simple peristome is strengthened at the edge by a delicate reddish rim (*Columna lubrica* var. *a*, *Columna lubricella* Ziegler, STABILE, Fauna Elvetica: delle Conchiglie terrestri e fluviali del Luganese, Lugano 1845 [1846], p. 34).

A. minima Siemaschko. "Shell minute, subcylindric, obtuse, thin, diaphanous, glossy. Whorls $5\frac{1}{2}$. Length $1\frac{3}{4}$, width $\frac{3}{4}$ lines" [= 3.5×1.5 mm.].—*Achatina minima* SIEMASCHKO, Bull. de la Société Impériale des Naturalistes de Moscow, xx, 1847, p. 111, pl. 1, f. 4 *a*, *b*, *c*.—PFR., Monogr. iii, 506; iv, 62, vi, 246.—CLESSIN Jahrb. D. Malak. Ges. 1875,

p. 42; Malak. Bl. n. F. ii, 1880, p. 201.—*Zua lubrica* form *minima* GALLENSTEIN, Jahrb. des Naturhist. Landes-Museums von Kärnten, xxvi, 1900, p. 88.

A. collina Drouet. "Shell small, oval-oblong, smooth, glossy, greenish-fawn or reddish, composed of 5 or 6 slightly convex whorls; aperture piriform; peristome a little thickened, with a whitish rim; columellar margin a little thickened. Length 3 to 4, diam. 1.5 to 2 mm. Under stones on the summits of dry sandy ridges at Fontaines, near Lyons (Terver), Mony-de-Oise (Baudon), and Liezey on the Vosges (Abbé Jacquel), quite rare" (Drouet). Sweden (Westerlund).

Achatina collina DROUET, Énumération des Mollusques terrestres et fluviatiles vivants de la France continentale, in Mémoires de la Soc. Royale des Sciences de Liège, x, 1855, p. 178, no. 31.—PFR., Monogr. iv, p. 620.

B. subcylindricus var. *exiguus* 'Menke' Moquin-Tandon. Shell smaller by a half. Metz; Crenoble. (Hist. Nat. Moll. France, ii, 1855, p. 304. BOETTGER, Bericht ueber die Senckenb. naturforsch. Ges. in Frankfurt a. M., 1889-90, p. 21, and of many other authors.) This form was not described by Menke, merely listed without description or locality; hence it dates from Moquin-Tandon's work, if worth retention.

Cionella (*Ferussacia*) *pulchella* Hartmann, Mousson. Differs from *lubrica* by the smaller size, less swollen shape, the whorls more loosely coiled, the polish less perfect, color paler, aperture less angular at the left side of the base, the columella less twisted at the end. Borschom, Transcaucasia. (Mousson, Journ. de Conchyl. xxi, 1873, p. 217.—PFR., Monogr. viii, 300).

In common with Pfeiffer and others, I have been unable to trace this name to Hartmann's works; but one of his papers, published in *Neue Alpina* for 1821-2 is not accessible to me. Mousson's form does not seem to differ from var. *lubricella*.

Var. *nilssoni* Malm. Shell smaller, more slender, nearly cylindric, whorls 5; whitish corneous, subhyaline. Length 5, diam. $1\frac{5}{6}$ mm. Aperture $1\frac{5}{6} \times 1$ mm. Sweden: Chris-

tianstad, at Ignaberga. (Malm, Götheborgs Kongl. Vetenskaps och Vitterhets Samhälles Handlingar, 1851, p. 123).

1f. *C. LUBRICA NITENS* 'Kok.' Gallenstein.

The shell is large, 7 to 8.5 mm. long, and usually dark colored.

Central Europe: Carinthia; Danube at Regensburg, in damp situations; Sweden and Finnland.

Similar large forms occur in Algeria, interior China (*C. davidis*), and Japan; but these eastern forms are probably independent derivatives from the wide-spread *lubrica* stock. Several names have been applied to the large European form or forms, but with present knowledge all may be referred to *C. l. nitens*. The original descriptions follow.

A. nitens 'Kokeil' Gallenstein. This snail differs from the preceding [*A. lubrica*, alt. 2.5 to 3, diam. 1 to 1.5 lines] by the considerably larger and darker colored shell. Marshland south of Klagenfurt, in grass etc., Carinthia. (*Achatina nitens* Kokeil, v. Gallenstein, Kärntens Land- und Süswasser-Conchylien, in Jahrbuch des naturhist. Landesmus. von Kärten, 1852, p. 75. Also the same Jahrbuch for 1900, p. 88, as *Z. lubrica* form *major*). Reported by Westerlund from Sweden and Finnland. In his later work Gallenstein gives the dimensions as 7 to 8.5 mm. long, 3.5 wide, and states that it occurs in damp places; while the var. *minima*, 4 to 5 x 1.8 mm., (with which he unites *lubricella* and *exigua*) inhabits dry places and high altitudes.

The name *nitens* was originally a collection name. It was never described by Kokeil. It was no doubt this form which Parreyss, in his *Verzeichniss* of 1849, listed as "var. *nitidus* Kokeil"; but without description. Gallenstein was the first to supply a definition of the race.

C. pfeifferi Weinland. Pl. 49, fig. 40. Shell dextral, imperforate, oblong-acuminate, subcylindric, smooth, glossy, pellucid, fulvous-corneous; whorls 7, a little convex, the last rounded. Aperture oval, a little acuminate above and below, scarcely one-third the total length; columella scarcely truncate; peristome straight, acute, not in the least thick-

ened. Length 10, width 3 mm. One living specimen found, Mt. Albem Suevicam near Hohen-Wittlingen." *Cionella pfeifferi* WEINL., Nachrbl. D. M. Ges. vi, 1874, p. 36, with figs.—*Cionella lubrica* var. *pfeifferi* WEINL., Zur Weichthierfauna der Schwäbischen Alp, in Jahreshefte des Vereins für vaterl. Naturkunde in Württemberg, xxxii, 1876, pp. 306, 311, pl. 4, f. 4.—Cf. v. MARTENS, Nachrbl. 1878, p. 39.)

The unique example was found in a mountain region where normal *C. lubrica* 4½ to 5½ mm. long is abundant. Professor von Martens believes it to be a scalariform monster. The figure is evidently very badly drawn.

Var. *maxima* Clessin. Large, the shell as much as 7.5 mm. long. Danube at Regensburg (*Clessin*, Nachrbl., 1908).

Achatina lubrica var. *grandis* Menke, 1830, undefined and without locality, but briefly referred to by Moquin-Tandon, (Moll. France ii, 1855, p. 304,) as Corsican, but without dimensions, may be identical.

Var. *major* Beck, 1837, undefined, and of Bourguignat, 1864, is a similar form, as yet not sufficiently known. It is thus described: Var. *major* Bgt. Shell a little larger [than 6-7 mm. long], whorls slightly more convex; around Algiers and Oran, Algeria.

Asiatic forms of Cochlicopa.

C. lubrica will probably prove to extend over all northern Asia, south to northern and western China. In Japan the specimens of *C. lubrica* from Garukawa near Sapporo, Yesso, are quite typical in form and color. On the islands Hachijo (pl. 48, fig. 31) and Nii, (fig. 32) of the Izu group, the shells are of stout figure, *very dark reddish-brown*, often opaque or flecked with yellow specks. The oblong-conic shell measures length 6, diam. 2.7, aperture 2.4, or 6.1, diam. 2.9, aperture 2.6 mm., with 5½ whorls. The lip is quite obtuse but it has not a very distinct internal rim. This variety has been named var. *hachijoensis* Pils. (Nautilus XVI, p. 57, Sept. 1902). Fossil specimens from Kikaiga-shima in the Loochoo Is. are similar to those of the islands of Izu, but a little smaller, 5 to 5.8 mm. long, and of course bleached.

At Shukunobe, Ojima, Yesso, the shells are very *large*, length 8.4, diam. 3, aperture 3 mm., with $6\frac{1}{4}$ whorls. The lip-rim is thin and narrow. The shape is oblong-conic, not cylindric like the shells from Sado. These specimens have the characters of *C. lubrica nitens* of Europe.

A series taken at Aikawa, Sado Island, Japan, by Mr. Hirase, one of them drawn on pl. 48, fig. 30, is perhaps referable to *C. davidis*. The shell is cylindric-oblong, either chestnut or of a beautiful, transparent greenish corneous tint. The outer lip has only a thin and very narrow internal rim (pl. 48, fig. 30).

Length 8.5, diam. 3, aperture 3 mm.; whorls $6\frac{1}{3}$.

Length 8, diam. 2.9 mm.

These shells are more cylindric, less conic than the large form from Yesso, otherwise being much like it. Whether these large Japanese shells are an independent race, or are genetically connected with *nitens* 'Kok.' Gall., or with *davidis* Anc., is a question we have not at present the means of solving.

That a form of the high country of central Asia should occur also on an islet in the Japan Sea seems intrinsically unlikely; yet I can find no ground for separating the Japanese form. It is not unlikely that the forms from both regions would more justly be ranked as subspecies of *C. lubrica*.

2. *C. DAVIDIS* Ancey.

"This species differs from *Zua lubrica* of our country by its larger size, less swollen, more parallel and more lengthened shape, and especially by the fold and sinuosity of the columella being more pronounced. It has 6 whorls. Length 8, diam. 2.75 mm." (*Ancey*).

China: Prov. Shensi, at Ying-dshia-pu (David, type loc.); Tshung-pu-sy, Feng-hsien (Obrutschew); Prov. Hu-bei at Badung (Fuchs); Prov. Gan-su at San-tshan and Tshing-yuan (Mlldff.).

Zua davidis ANCEY, Le Naturaliste 1882, p. 45 [not seen by H. P.]; Il Nat. Siciliano ii, 1883, p. 269, no. 55.—*Cionella davidis* GREDLER, Malak. Bl. n. F. ix, p. 141.—*Zua davidia* STURANY, Denkschr. k. Akad. der Wissenschaften, vol. 70,

1901, p. 37 (1901).—*Cochlicopa davidis* MLLDFF. Ann. Mus. Zool. de l'Acad. Imp. Sci. St. Petersb. vi, 1901, p. 389.

"It is quite constant in size as well as in the several other characters enumerated above, which seem to me sufficient to give this *Zua* specific rank" (*Ancey*).

"Always easily recognized by the slower increase of the whorls, narrower shape and smaller aperture" (*Mlldff.*).

For the occurrence of *davidis* or a similar form on Sado Island, see p. —.

3. *C. SINENSIS* Heude. Pl. 48, figs. 23.

Shell, small, with smooth glossy epidermis; spire conic-acuminate; whorls 7, oblique, regular. Aperture oval; peristome simple, thick, continuous, interrupted at the external sinus. Length 7, diam. 2 mm. (*Heude.*)

China: Prov. Sytshuan at Tsheng-hou (*Heude*); Tapa; valley of the Tung (*Mlldff.*).

Zua sinensis HEUDE, Notes sur les Moll. terr. de la Vallée du Fleuve Bleu, pt. 3, 1890, p. 151, pl. 35, f. 17.—*Cochlicopa sinensis* MLLDFF, Ann. Mus. Zool. Acad. Imp. Sci. St. Petersb. vi, 1901, p. 389.

"Very small and slender, the aperture smaller than in the preceding [*C. davidis*]" (*Mlldff.*).

This form and the preceding are admitted as species in deference to the opinion of von Moellendorff, but they are certainly very closely related to some forms of *C. lubrica*.

4. *C. THALASSINA* (Jousseaume). Pl. 52, fig. 1.

Shell imperforate, minute, elongate, fragile, diaphanous, polished, whitish; spire produced, regularly tapering-cylindric, a little obtuse at the summit. Whorls 6 to 7, a little convex, regularly increasing, separated by a slightly impressed suture, the last whorl convex. Aperture vertical, ovate; peristome acute, slightly spreading and a little thickened within; columellar margin a little arcuate, slightly thicker; outer margin a trifle arching forward; margins joined by a very thin callus. Length 2.25, diam. 1, aperture 0.75 x 0.5 mm. (*Jouss.*).

Aden, in debris of a small torrent.

Zua thalassina JOUSS., Bull. Soc. Malac. France vii, 1890, p. 88, pl. 3, f. 12, 13.

This smallest species of the genus is distinct by its delicacy and minute size. Known only by the original figure and description.

Genus HOHENWARTIANA Bourguignat.

Hohenwartiana BGT., Revue et Mag. de Zool., xvi, 1864, p. 201 (Moll. nouv., litig. on peu connes, sect. 40, p. 119); Malacologie de l'Algerie ii, 1864, p. 25, type *Achatina hohenwarti* ROSSM.—*Hohenwarthia* BGT. in LETOURNEUX et BOURGUIGNAT Prodrôme de la Malacologie terr. et fluv. de la Tunisie, 1887, p. 126, substitute for *Hohenwartiana* BGT. 1864.

Shell small, very fragile, translucent and glossy, oblong-fusiform, composed of 5 to 7 nearly flat whorls, the last tapering to the base; summit obtuse, rounded. Aperture piri-form, toothless, the outer lip acute, arching forward, columella straight, tapering or a little excised below, but not really truncate, not reaching the base. Soft anatomy unknown.

Type *H. hohenwarti*. Distribution, Mediterranean countries.

This group stands close to *Cæcilioides*, from which it differs chiefly by its more obese shape, approaching the genus *Ferussacia*, and by the absence of a columellar truncation. It is restricted to the countries bordering on the Mediterranean. As in other oblong shells in which the whorls increase irregularly, the general shape, and the proportion of the aperture to the whole length of the shell vary with age, so that at successive stages of growth the general appearance is quite different. The large number of nominal species is due to this cause, to the rarity of good figures, and to the lack of any ardent desire to find out what the older species really are.

The following undescribed forms are apparently referable to *Hohenwartiana*:

Ferussacia berytensis BGT., Rev. et Mag. Zool. 1864, p. 211, no. 45. Syria. Name only.

Hohenwarthia maresiana and *Hoh. mauritanica* are recorded by Bourguignat and Letourneux in Prodr. Mal. Tunisie p. 126, as Algerian species. *Names only.*

A form from near Naples has been named *Cionella persianii* by Tiberi (Annales de la Societe Malacologique de Belgique, xiii, 1878, p. 21), but without description or information other than the statement that it was what he had previously called *C. hohenwarti*.

1. *H. HOHENWARTI* (Rossmäessler). Pl. 51, figs. 1, 2.

Shell smaller, subfusiform, rapidly increasing with tapering spire, buff, brilliant, polished. Aperture long-piriform, angular, peristome unexpanded, acute, simple, the outer margin convex. Length 3, diam. 1 lines; whorls scarcely 6. (*Rossm.*).

Carniola: at Laibach, in debris of the river and under stones on its banks (Count von Hohenwart, type loc.); entire Dalmatian coast (Kuester).

Achatina hohenwarti ROSSM., *Iconographie* ii, pt. 10, 1839, p. 34, pl. 49, f. 657.—PFR., *Monogr.* ii, 274; iii, 505; iv, 622; vi, 251; viii, 306; *Conchyl. Cab.* p. 353, pl. 29, f. 14, 15.—*Cæcilianella h.*, BOURGUIGNAT, *Revue et Mag. de Zool.*, 1856, p. 382.—*Ferussacia h.*, BGT., *Moll. nouv. litig.* ii, pl. 30, f. 9-11.—DE BETTA, *Atti del Regio Istituto Veneto di Sci., Lett. ed Arti*, Ser. III, xv, pt. 2, pp. 1451, 1507 (1870).—*A. hohenwardti* ROSSM., KUESTER, *Neunter Bericht Naturforsch. Ges. Bamberg*, 1870, p. 91.—*A. hohenwarthii* SCHMIDT, *Syst. Verzeich.* p. 13.—? *Helix pusilla* SCACCHI, *Osserv. Zool.* 1833, p. 26.

This species has been reported from Italy, Corsica, France, Spain and Algeria, but this wide range no doubt applies to the several forms which have been segregated by some authors as varieties, by others as species. Examination of large series by an unprejudiced observer will be necessary to determine the status of these supposed species.

Achatina lubricoides Potiez et Michaud (*Galerie des Moll. on Catal. Moll. Mus de Douai*, i, 1838, p. 129, pl. 11, f. 9, 10), from Rimini, is evidently *H. hohenwarti* or a closely related

form. It is described as resembling "*A. lubrica*, but it is longer and has a different appearance." Whether it is identical with *Helix* (*Cochlicopa*) *lubricoides* Fér., Tabl. Syst. p. 51, no. 372, *undescribed*, is not certainly known.

I have figured, pl. 51, figs. 10, 11, a shell received from Terver as "*A. lubricoides* Jan." It is related to *hohenwarti*, but differs by the much more lengthened spire, and the more irregular descent of the suture, as shown in the figures. The outer lip arches forward more than in *H. hohenwarti*. The early whorls are less narrow and the penultimate whorl widens less rapidly than in *H. bourguignatiana*. Length 6.3, diam. 2mm. Italy: Milan.

Var. *iriana* Pollonera. Differs from the typical form by its more elevated spire, larger size, somewhat wider aperture and less twisted columella. Length 7 to 8, diam. 2.25 to 3.25 mm. Debris of the Scrivia at Carbonara, Piedmont. (POLL., Moll. terr. viv. in Piemonte, Atti R. Ac. Sci. di Torino, 1885, xx, 693).

Var. *psilia* Bourguignat. Distinguished from the related *hohenwarti* by its larger size, corneous tint, and the irregular increase, the early whorls very close, the last three very wide. Tuscany (BGT., Malac. de l'Algerie ii, p. 33, no. 43, 1864).

Var. BUGESI (Bourguignat). Pl. 51, figs. 3.

Differs from *H. moitessieri* by the larger shell, less swollen, the whorls increasing irregularly (the two upper slowly, the rest more rapidly), by the less oblong aperture, smaller and less narrowly angular above; the columella is straighter, with weaker truncation, and finally the last whorl descends rapidly. Length 5, diam. 2 mm.; whorls 6.

France: debris of the Lez at Montpellier.

Ferussacia bugesi BGT., Moll. nouv., litig. etc., p. 184, pl. 30, f. 12-14.—PFR., Monogr. viii, p. 307.

I cannot see that this differs materially from *H. hohenwarti*.

2. *H. LOCARDI* ('Bgt.' Locard). Pl. 51, fig. 9.

Shell ovoid-fusiform, nearly smooth, very glossy and sub-transparent. Whorls 5 or 6, the first increasing slowly, the

last 3 more rapidly, last whorl $\frac{2}{3}$ the total alt. Columella straight, twisted, with a distinct projection at base giving a false aspect of truncation. Length 6, diam. $5\frac{1}{2}$ mm.

France: debris of the Rhone (Locard).

Ferussacia locardi Bgt., LOCARD, Etudes sur les Variations Malacologiques, i, 1880, p. 221, pl. 3, f. 19.

There is evidently an error in the measurements.

3. H. MOITESSIERI Bourguignat. Pl. 51, fig. 4.

Shell minute, oblong, glossy, polished, hyaline, glassy. Spire short, acuminate, the apex rather obtuse; whorls 6 to 7, slowly and regularly increasing, penult. and last large, separated by a distinct, conspicuously doubled suture, the last whorl dilated, a little convex, neither ascending or descending, more than half the total length. Aperture oblong-piriform, narrowed and acutely angular above; columella curved, not reaching the base, slightly truncate; peristome unexpanded, acute; outer lip regularly arching forward, margins joined by a thin callus. Length 5, diam. 2 mm. (*Bgt.*).

France: debris of the Lez at Montpellier (Dr. Buges, type loc). Italy: debris of the Po at Turin.

Ferussacia moitessieri BGT., Moll. nouv., litig. et peu connes, 1866, p. 182, pl. 30, f. 6-8.—PFR. Monog. viii, p. 307.—*Cionella m.*, WESTERL., Fauna iii, p. 171.—*Cæcilianella m.*, POLLONERA, Atti R. Accad. Sci. Torino, xx, 1885, p. 693.

The shell is said to differ from *hohenwarti* by the more delicate, clearer, more glossy shell, which is wider in the lower part, with shorter, more acuminate spire; the whorls increase more regularly and not so fast; the aperture is narrower above, and longer in proportion to the shell's length.

4. H. BOURGUIGNATIANA (Benoit). Pl. 50, figs. 9; pl. 48, figs. 24-26.

Shell oblong-cylindric, polished, pellucid, whitish-buff. Spire turrite, passing into a short cone, the apex rather obtuse; suture quite impressed, very narrowly margined. Whorls 5 to 6, a little convex, the two last very rapidly en-

larging, the last flattened-cylindric, about equal to the spire. Columella subvertical, intorted, obsoletely and obliquely truncate, not reaching the base. Aperture ovate-angulate, peristome simple, unexpanded, acute, the margins joined by a thin callus, outer lip slightly arching forward, subexpanded. Length 6.5, diam. 2.33, aperture 3×1.3 mm. (Benoit).

Sicily: Palermo, type loc.; Algeria at Bone; Crete; Dardanelles; Samsun, Asia Minor.

Achatina bourguignatiana BEN., Illustr. test. estr. Sicil. pt. iv, 1862, p. 241, pl. 8, f. 5.—*Ferussacia b.*, BGT., Malac. Alger. ii, p. 68, pl. 4, f. 35-40; Revue et Mag. Zool. xvi, 1864, p. 212.—*Cochlicopa b.*, CAFICI, Il Nat. Sicil. i, p. 204.

A peculiar species, not well described by Benoit. It is characterized by the second whorl being disproportionately large, the following whorl narrower; then the last two whorls increase with great rapidity, the last $1\frac{1}{3}$ turns of the suture descending very steeply. It is figured on pl. 50 from a specimen received from Benoit. Bourguignat's figures are copied, pl. 48, figs. 24-26. It has been recorded from various points around the eastern basin of the Mediterranean.

5. *H. THAMNOPHILA* (Bourguignat). Pl. 51, figs. 7, 8.

Shell very minute, very fragile, clear glassy, polished; spire attenuate, terminating in a short cone; apex rather obtuse, somewhat mamillate. Whorls 6, slightly convex, irregularly increasing, the first two rapidly widening, third slowly, the fourth and rest rapidly increasing, separated by a rather impressed and duplicated suture, the last almost half the total length. Aperture oblong; columella scarcely lamellose, not reaching the base, and appearing subtruncate; peristome unexpanded, acute, the outer margin arching forward, especially in its anterior part; margins joined by a very thin callus. Length 4, diam. 1.25, aperture 1.75 mm. (Bgt.)

Algeria: drift debris of the Frais-Vallon, 1 kilometer below the fortifications of Algiers, near the gate Babel-Oued (Bgt.). Also occurs in Sicily (Benoit, Cafici).

Ferussacia thamnophila BGT., Malac. de l'Algerie ii, p. 69, pl. 4, f. 41-44 (1864).—BENOIT, Catalogo p. 86.

The smallest, most fragile and slenderest of the species.

6. *H. MACEI* Bourguignat.

Shell lanceolate-fusiform, with pointed produced spire and obtuse apex. Whorls 6, somewhat convex, irregularly increasing, the penultimate very large, widened, the last scarcely larger, convex, somewhat more than one-third the total length. Aperture narrowly piriform, very acute above, scarcely dilated below, the outer lip arching forward. Columella stout and short. Length 7, diam. 2.5 mm. (*Westerl.*)

France, between Cannes and Napouli.

Ferussacia macei BGT., Deser. Moll. Alpes-Maritimes p. 9, 1870.—*Cionella m.*, WESTERLUND, Fauna p. 174.

7. *H. CAZIOTI* (Locard).

Long-lanceolate, the spire very short; 6 whorls, the first 5 increasing very slowly, very regularly, perceptibly convex, the last whorl very long, not swollen. Aperture very narrow, very high very strongly angular above, more than half the total length of the shell. Columella short and arcuate below; peristome thin, sharp, the outer lip feebly arched forward; callus very thin. Shell hyaline, very glossy. Length 6.5, diam. 2 mm. (*Loc.*).

France: debris of the Rhone at Avignon.

Ferussacia cazioti LOCARD, Coq. terr. de France, in Ann. Soc. d'Agriculture, Sci. et Ind. de Lyon, (7 ser.) iii, 1895, p. 142 (1896).

8. *H. PALADILHI* Bourguignat. Pl. 51, figs. 12, 13.

Shell *slender*, elongate-lanceolate, hyaline-glassy, polished glossy; spire produced, lanceolate, the *apex very obtuse*. Whorls 7, slightly convex, *regularly* and rather rapidly increasing, separated by an impressed, duplicate suture, the last whorl large, less than half the total length, a little descending. Aperture piriform, angular above, a little dilated below. Columella slightly subtruncate, not reaching the base; peristome unexpanded, acute, the outer lip arched forward, especially in the lower part, margins joined by a thin callus. Alt. 6, diam. 2 mm. (*Bgt.*).

France: drift debris of the Lez at Montpellier.

Ferussacia paladilhi BGT., Moll. nouv., litig. etc. ii, no. 57, p. 186, pl. 30, f. 18-20.

Differs from *eucharista* by the more slender shape and more obtuse apex. It is also more slender and lanceolate than *moitessieri* and *bugesi*. Considered a *Hohenwarthia* by Bourguignat, though it is as slender as *Cæcilianella*. It has been reported by Letourneux also from Philippeville, Algeria (Ann. de Malac. i, p. 322).

9. *H. EUCHARISTA* (Bourguignat). Pl. 51, fig. 6.

Shell very slender, very fragile, glassy, very glossy, sub-fusiform-turrite; spire lanceolate, gradually acuminate, the apex rather obtuse. Whorls 7, a trifle convex, rapidly and rather regularly increasing, separated by an impressed, duplicate suture, the last more than one-third the total alt. Aperture slightly oblique, oblong, angular above; columella minute, not reaching the base, slightly subtruncate; peristome unexpanded, acute, outer margin rather strongly arched forward, the margins joined by a rather thick callus. Length 6, diam. 2, aperture 2.5 mm. (*Bgt.*).

Algeria: debris of the Frais-Vallon near the Bab-el-Oued gate, Algiers; debris of the Harrach, etc.

Ferussacia eucharista BGT., Malac. de l'Algerie ii, 1864, p. 67, pl. 4, f. 45-47; Moll. nouv., litig. etc. pl. 30, f. 15-17.

10. *H. TUNETANA* Letourneux et Bourguignat.

Shell elongate-oblong, very fragile, glassy, very glossy, hyaline, highly polished; spire produced, obtuse at the summit, the apex stout, rounded. Whorls 6, slightly convex, regularly and rapidly increasing, separated by a somewhat impressed suture, the last whorl large, nearly half the total length, convex. Aperture vertical, oblong; columella straight, having a longitudinal lamella within; peristome unexpanded, fragile, the outer margin regularly arcuate; margin joined by a thin callus. Length 7, diam. 2, aperture 3 mm. (*L. & B.*)

Tunis: drift debris of the Oued Sidi-Aich.

Hohenwarthia tunetana L. et B., Prodr. Mal. Tunisie p. 126, 1887.

11. H. PECHAUDI Bourguignat.

Shell elongate, fragile, glassy, glossy, whitish, polished. Spire produced, regularly tapering, a little obtuse at the summit, apex minute. Whorls 7 to 8, hardly convex until the last one, regularly and rather slowly increasing, parted by a linear suture; the last whorl large, nearly half the total length. Aperture vertical, irregularly piriform-elongate, very much contracted above, having a minute lamella within on the convexity of the penult. whorl. Columella short, arcuate, lamellose or as though truncate below. Peristome unexpanded, fragile, the outer margin slightly arcuate, margins joined by a callus. Length 6.5, diam. 2, alt. apert. 3 mm. (*Bgt.*).

Tunis: drift of the Medjerda near Ghardimaou.

Hohenwarthia pechaudi Bgt., LET. et BGT., Prodr. Mal. Tunisie 1887, p. 127.

Remarkable for its parietal lamella.

12. H. HAGENMULLERI Bourguignat.

Shell minute, oblong-elongate, fragile, diaphanous, somewhat whitish, polished; spire moderate, produced, a little obtuse at the summit; whorls 6, slightly convex, slowly increasing to the fourth, then more rapidly, separated by a linear suture. Last whorl large, half the total length, a little convex. Aperture vertical, piriform, narrowed above. Columella short, stout, subtruncate below; peristome unexpanded, fragile; outer lip strongly arching forward, margins rather strongly joined by a callus. Length 4, diam. 1.5, aperture 2 mm. (*Bgt.*)

Tunis: drift of the Medjerda near Ghardimaou.

Hohenwarthia h. Bgt., LET. et BGT., Prodr. Mal. Tunisie, 1887, p. 127.

13. H. BIONDIANA (Benoit). Pl. 50, figs. 10.

Shell oblong-fusiform, polished, glittering, pellucid, buff-whitish; spire turrite-conic, short, the apex obtuse; suture impressed, submarginate, obliquely descending. Whorls 5, but slightly convex; the last large, suddenly widening, longer

than the spire. Columella subvertical, a little twisted inward, obsoletely truncate, not reaching the base. Aperture oblong-acuminate; peristome simple, unexpanded, acute, the margins joined by a very thin callus. Length 5.5, diam. 2, aperture 3 x 1 mm. (*Benoit*).

Sicily: estate of the Prince of Petrella, near Palermo (*Benoit*, type loc.); Syracuse, in debris of Anapo (Cafici).

Achatina biondiana BEN., Ill. test. estramar. Sicil. pt. 4, 1862, p. 239, pl. 8, f. 6.—*Cochlicopa b.*, CAFICI, Il Nat. Siciliano i, p. 204.—*Ferussacia biondina* PFR., Monogr. vi, 252.—BGT. Rev. et Mag. Zool. 1864, p. 211.

In fig. 10 a specimen received from Benoit is drawn. It differs from *H. hohenwarti* by the different curvation of the outer lip in profile, *hohenwarti* being evenly arcuate, while *biondiana* is more convex below the middle; moreover the aperture is shorter. The last half of the first and first half of the second whorl is enlarged, after which the whorls increase slowly to the penultimate, which with the last increases very rapidly.

14. *H. ARADASIANA* (*Benoit*). Pl. 51, figs. 14, 15.

Shell oblong-cylindric, polished, glittering, pellucid, corneous-buff; spire turritic-conic, the apex mamillate; suture rather impressed, indistinctly marginate. Whorls 5, a little convex, very rapidly enlarging, the last not as long as the spire. Columella subvertical, slightly twisted inward, narrowly truncate at the base. Aperture oblong-acuminate; peristome simple, unexpanded, acute, margins joined by a hairlike callus, the right margin somewhat arching forward. Length 4.5, diam. 4.75 [*sic*], aperture 2 mm. long, 1 wide. (*Ben.*).

Sicily: Palermo, near the Oreto river.

Achatina aradasiana BEN., Illustr. etc., p. 244.

Figured from a specimen received from Benoit. The first half whorl is rather small; the following whorl very large; at the end of $1\frac{1}{2}$ whorls the whorl contracts again, the suture becoming subhorizontal. The last turn of the suture is very oblique, steeply descending. The sutural border is

whitish and wide. The outer lip arches far forward, in profile view, the greatest convexity being below the middle. It is extremely similar to *H. bourguignatiana*, but differs by the smaller size and less swollen basal portion.

15. *H. villæ* (Benoit).

A fine and elegant little shell resembling a *Cionella* in form. It is obese, fusiform, lucid, diaphanous, smooth, transparent, very obtuse at the end. Whorls 5, rather convex, suture superficial, accompanied by a line. Last whorl one-third the total length. Aperture rounded at the base, acutely angular above; peristome simple, acute, the margins joined by a callus visible under the lens. Columella scarcely truncate. Sicily: near Palermo, extremely rare. (*Cæcilianella villæ* BEN., Catalogo, 1881, p. 89).

Perhaps related to *H. alleryi* Cafici.

16. *H. alleryi* (Cafici). Pl. 51, figs. 16, 17.

Shell oblong-subventricose, very minute, very fragile, diaphanous, very glossy, pale corneous-buff; spire short, the apex obtuse as though mamillate. Whorls 5, slightly convex, all to the fifth slowly increasing, the fifth increasing extremely rapidly; suture well impressed and duplicate. Last whorl almost exceeding three-fourths the total length. Aperture oblong, angular above; columella subvertical, not reaching the base, subtruncate; peristome unexpanded, acute, the outer margin arcuate, margins joined by a thin callus. Length 3.75, diam. 1.5, length of aperture 2.5 mm. (*Cafici*).

Sicily: Abita Nociforo near Vizzini.

Cochlicopa alleryi CAFICI, Il Naturlista Siciliano, i, p. 202, pl. 10, f. 1a, 2a, June, 1882.

A shorter, more compact form than other Sicilian species, if it is a mature shell.

17. *H. NAUTICA* (Westerlund).

Shell fusiform turrite, with long, rapidly tapering spire. Whorls $6\frac{1}{2}$ to 7, very weakly convex, rapidly and regularly increasing, the last somewhat more than one-third the total

length; suture impressed, oblique, margined. Aperture oblong-piriform, acuminate above, narrowly rounded below; parietal margin very oblique; outer margin produced forward; columella very short, gradually passing below into the basal margin. Length 7 to 7.3, diam. 2, length aperture 2.5 mm. (*Westerl.*).

Crimea: Sudak, in drift debris.

Cionella (Hohenwarthia) nautica WESTERL., Fauna iii, 1887, p. 173; no. 98.

18. *H. ANCEYI* (Westerlund).

Shell in all respects indistinguishable from *nautica*, but somewhat larger, with traces of a horny-yellow epidermis; aperture somewhat longer (almost half the total length); columella rather wider and at the base produced and rounded, bounded by a thread-like lamina, but especially distinguished by the quite fine but deep and wholly marginless suture (*Westerl.*).

France: Marseilles (Ancey).

Cionella (Hohenwarthia) anceyi WESTERL., Fauna iii, p. 173, no. 99.

19. *H. MALTZANI* ('Clessin' Westerlund).

Shell fusiform with slender spire, whorls 6, flat, the third and fourth nearly equal, the fifth somewhat higher, the last as high as the others taken together. Suture oblique, that between whorls 4 and 5 high above the middle of the shell. Aperture half the total length, narrowly drop-shaped, long acuminate above. Outer lip produced forward below the middle. Columella bounded by a thread-like lamina, strongly arcuate below. Length 5, diam. 1.5 mm.

Crete.

Cionella (Hohenwarthia) maltzani Clessin, WESTERLUND Fauna iii, 1887, p. 174, no. 100.

20. *H. DISPARATA* (Westerlund).

Related to *C. hohenwarti*, but with $5\frac{1}{2}$ to 6 whorls, the upper $3\frac{1}{2}$ to 4 small, narrow, forming a short conic spire, the last two large, rather convex, together scarcely reaching two-

thirds the length of the penultimate; penultimate whorl shorter than the rather convex last whorl. Suture strongly margined, horizontal above, strongly oblique in the middle, and slightly oblique towards the aperture. Aperture not dilated below, not half the total length of the shell; outer margin rather strongly arching forward. Length 6 to 6.5, diam. 2 mm. (*West.*).

Spain: near Barcelona (Prof. P. T. Cleve).

Cionella (*Hohenwarthia*) *disparata* WESTERL. Verhandl. k.-k. zool.-bot. Ges. Wien, 1893, xlii, p. 43.

Genus COILOSTELE Benson.

Coilostele Bs., Annals and Magazine of Natural History, 3d series, xiii, p. 136 (Feb. 1864), for *C. scalaris* Bs.—*Coelostele* of some authors.—*Cælestele* BOURGUIGNAT, Description de diverses espèces de Cælestele et de Paladilhia, p. 6 (1880).—*Francesia* PALADILHE, Annali del Museo Civico di Storia Naturale di Genova iii, 1872, p. 9, type *F. scalaris* Palad.= *paladilhiana* Nevill.

Shell minute (3 to 4 mm. long), fragile, somewhat transparent, imperforate, long and narrow, *subcylindric* or tapering slightly to the *very obtuse rounded summit*, composed of 6 to 8 flattened whorls separated by *deep sutures*, the first $2\frac{1}{2}$ or 3 whorls smooth, the rest either smooth, striate or ribbed. Aperture small, oblong, more or less oblique, the outer lip usually expanded slightly in fully adult shells, straight in profile. Columella having a low fold at its junction with the parietal wall. *Internal partitions absorbed in adult shells*, leaving only an internal spiral cord along the sutures. Soft anatomy unknown.

Type *C. scalaris* Bens. Distribution, India, Aden, Syria, Abyssinia, Egypt, Southern Spain, Eastern Mexico.

A genus of uncertain position, remarkable for the cylindrical shape of the minute, fragile slender shell, and the absorption of the internal partitions, which I have verified in *C. tampicolensis*. They have been found up to this time only as dead shells in the drift debris of rivers and streams, where they occur in great profusion, though it seems quite locally.

Nothing is known of the life history or soft parts. The baleful influence of the "nouvelle école" authors impedes the study of the species, which have been unduly multiplied on trivial grounds. In the absence of a large series from Seville, I am unable to say to what extent the Spanish species vary in sculpture. Bourguignat divides the genus into three groups, according to the sculpture. The known forms fall into these groups as follows.

Smooth: *scalaris*, *africana*, *egyptiaca*, *acus*, *laevigata*, *castroiana*, *hispanica*.

Striate: *paladilhiana*, *isseli*, *stenostoma*, *bourguignati*, *servaini*, *tumidula*.

Ribbed: *letourneuxiana*, *raphidia*, *cylindrata*, *tampicoensis*.

A single Eocene species is known, *Coelostele eocaena* Oppenheim, from the Val dei Mazzini, Italy. It seems to be quite a typical *Coilostele* in all respects, and is of high interest as showing the genus to have been one of those probably developed in the Mesozoic European archipelago, like the ancestral *Clausiliidæ* and *Megaspiridæ*. (See Oppenheim, Zeitschr. d. Deutsch. Geol. Gesellsch. vol. 47, 1895, p. 119, pl. 3, fig. 10).

The name *Coilostele*, hollow pillar, is in allusion to the absence of internal partitions in the species examined by Benson, verified by me in *C. tampicoensis*.

Asiatic and East African Species.

1. *C. SCALARIS* Benson. Pl. 50, fig. 3.

Shell imperforate, long-cylindric, smooth, hyaline, glossy; spire long, gradually tapering, scalariform; apex obtuse; suture deep. Whorls 6, a little convex, obtusely angular above, the penultimate whorl cylindric. Aperture suboblique, semioval, subpiriform; peristome thin, unexpanded, the margins remote; columellar margin a little thickened, provided with an oblique, long, spiral entering fold above. Length 3, diam. scarcely 1 mm.; aperture 0.66×0.5 mm. (*Bens.*).

India: Betwa river, in sand; Jumna river opposite Humearpore (Benson); Ganges river drift (Hutton); Sind (Blanford).

Coilostele scalaris BS., Ann. and Mag. Nat. Hist. 3d. ser., xiii, p. 136 (Feb. 1864).—PFR., Monogr. Pneumoporum Viv., suppl. 3, p. 370.—*Cælostele scalaris* BGT., Deser. Cœl. p. 10.—NEVILL, Handlist Moll. Ind. Mus. i, p. 162.

“Perfectly smooth, except that there are a few distant broad varix-like ribs on the penultimate whorl” (*Nevill*).

2. *C. PALADILHIANA* Nevill. Pl. 50, fig. 4.

Shell turrite, nearly cylindric, imperforate, pellucid, hyaline, glossy, sharply and regularly flexuously costulate. Spire long, slightly tapering to the very obtuse apex. Whorls $6\frac{1}{2}$ to 7, but slightly convex, flattened, gradually and regularly increasing in width and height; suture impressed, subduplicated, a flat belt below it. Last whorl larger than the penult., being measured behind one-fifth the total length, ascending towards the aperture. Outer lip in profile straight, very obliquely receding below. Aperture a little oblique, narrowed transversely, a little dilated below, oblong, subelliptical, somewhat resembling a human ear reversed; the outer margin a little produced and narrowly arcuate at the upper insertion. Peristome unexpanded, subcontinuous, thin, a trifle thickened; columellar margin continued obliquely from the parietal wall, a little flexuous, and noticeably projecting at the junction with the parietal wall; right margin elongated and moderately arcuate. Length 3, diam. 0.75 mm. (*Palad.*).

Aden: drift debris of the Kursi.

Francescia scalaris PALADILHE, Annali del Mus. Civ. di Stor. Nat. di Genova, iii, Dec. 1872, p. 10, pl. 1, figs. 1-4. Not *C. scalaris* Bens. Cf. ISSEL, Annali vol. 4, p. 522. *Coelostele paladilhiana* NEVILL, Handlist Moll. Ind. Mus. i, p. 162 (1878), based upon Paladilhe's description.—*Cælestele arabica* BGT., Deser. Cœl., p. 15 (1880), based upon the same description.—*Coelostele* sp., BLANFORD, Journ. Asiatic Soc. of Bengal, vol. 44, 1875, p. 44.

“Only distinct from the preceding [*C. scalaris*] by the distinct, almost microscopic striation, and the whorls being a trifle less cylindrical” (*Nevill*). Issel reports this species from the arid islet Sek Sayd, near Massaua, the shells agreeing exactly with those from Aden.

Var. *isseli* Bourguignat. Differs from *C. paladilhiana* by the more lengthened shell, whorls more detached, more swollen around the upper part and more separated by the deeper suture; striæ finer and closer; aperture more oblique and shorter. In *isseli* the long lanceolate spire tapers gradually without being ventricose; in *paladilhiana* the spire is a little swollen in the middle. Length 3.5, diam. 0.75 mm.; whorls 7. Found in the torrent Kursi, near Aden. Probably an individual variation of *C. paladilhiana*.

3. *C. BOURGUIGNATI* Jousseume. Pl. 50, fig. 5.

Shell imperforate, very minute, elongate, mamillate at the summit, cylindric in the middle, relatively tumid there, fragile, diaphanous, becoming rather opaque after death, hyaline or whitish, sharply striatulate, the striæ close, regular, slightly oblique. Spire long-cylindric, swollen-mamillate and very obtuse at the summit. Whorls 7 to 8, the embryonic swollen, median a little convex, slowly increasing, separated by an impressed suture, the last whorl convex, relatively quite swollen. Aperture very oblique, ovate, peristome acute, unexpanded, very slightly thickened within; columella twisted, as though plicate. Length 3, diam. 0.33, alt. aperture 0.33, width 0.5 mm. (*Jouss.*).

Aden: drift debris of torrent on the plain of Mahala.

Coelestele bourguignati Jouss., Bull. Soc. Malac. de France vii, 1890, p. 95, pl. 3, f. 16-18.

This handsome species, remarkable for the extreme obliquity of the aperture, has a mamillate summit, relatively so large that the median whorls appear slim, and quite disproportionate to the size of the summit and the last whorl (*Jouss.*).

4. *C. STENOSTOMA* Jousseume. Pl. 50, fig. 8.

Shell imperforate, elongate, exactly cylindric, not more ample at base than at the summit, fragile, subopaque, whitish, delicately striate, the striæ close regular and suboblique. Spire long-cylindric, scarcely tapering, obtuse at the summit. Whorls 7, slightly convex or subplanulate, slowly increasing,

separated by a deep narrow suture, the last whorl little convex. Aperture subvertical or suboblique, narrow, long; peristome unexpanded, a little thickened and spreading at the base, thicker and reflexed at the columellar margin; the margins joined by a callus. Length 3, diam. 0.5, aperture 0.33 x 0.25 mm. (*Jouss.*).

Aden: drift debris of a torrent in the plain of Mahala.

C. stenostoma JOUSS., Bull. Soc. Malac. de France, vii, p. 96, pl. 3, f. 19-21, 1890.

Very characteristic by its long-cylindric shape, almost as wide at the summit as at the base; by the slightly convex whorls, almost flat, and separated by a deep sutural gutter, and by the remarkable narrowness of the aperture (*Jouss.*).

5. *C. AFRICANA* Bourguignat.

Shell imperforate, cylindric, smooth, diaphanous, glassy. Spire long-scalariform, slightly tapering, mamillate at the summit, apex very stout, very obtuse. Whorls 7, flattened, strongly swollen around the suture, regularly and slowly increasing, the last slightly larger, convex. Aperture very oblique, suboblong, angular above, rounded below. Peristome unexpanded, lightly thickened and whitish; columellar margin arcuate, a trifle thickened, not plicate. Length 3, diam. 0.75 mm. (*Bgt.*).

Egypt: drift of the Nile at Damietta.

Cœlestele a., BGT., Descr. Cœl., p. 11, 1880.—JOUSSEAUME, Bull. Soc. Malac. France VII, p. 88 (near Massouah).

Differs from *C. scalaris* by the mamillar summit, closer coil, there being 7 instead of 6 whorls in the same length, by the very oblique aperture, well rounded basally, the arcuate columellar margin, not thickened, and without a fold above. As in all other Cœlesteles known to me, the columellar axis is wanting above the penult. whorl (*Bgt.*).

6. *C. ÆGYPTIACA* Bourguignat.

The distinctive sign of this species is in the perfectly cylindric shape. In *C. scalaris* and *africana* the shell enlarges gradually in diameter. In *ægyptiaca* the whorls are smaller,

more delicate and a little less scalariform. The first two are convex, the rest flat, swollen at the suture. The shell is smooth. Length 2.5, diam. 0.5 mm.; whorls 6.

Egypt: drift of the Nile at Damietta.

Cælestele ægyptiaca Bgr., Descr. Cæl., p. 12.

Doubtfully distinct from the preceding.

7. *C. CYLINDRATA* Boettger. Pl. 50, figs. 6.

Most related to *C. raphidia* Bgt., but the shell is more exactly cylindric, narrower, apex more obtuse, the aperture smaller.

Shell small, subrimate, very slender, almost exactly cylindric, thin, pellucid, glossy; spire with subparallel sides, slightly tapering upwards, the apex very obtuse, globose. Whorls 8, very slowly increasing, separated by a deeply impressed suture, the upper ones more convex, the rest flattened in the middle, rudely but subobsoletely costulate and sometimes here and there varicose; costulæ oblique, filiform, compressed. The last whorl is flattened in the middle with 20 to 30 riblets, a little higher and scarcely wider than the penult. whorl, equal to one-fifth the total length of the shell. Aperture small, oblong, slightly acute above and below, receding at the base; peristome subcontinuous, the margins distinctly but very delicately reflexed, columellar margin broadly appressed, and callously reflexed above the rimation; columella sigmoid, in the middle very distinctly twisted or with a unilamellate appearance. Length 3.25 to 3.75; diam. 0.75 to 0.875 mm.; alt. aperture 0.75, width 0.5 mm. (*Bttg.*).

Asia Minor: debris of the Sarus river, Adana, Cilicia.

Cælostele cylindrata BTTG., Nachrbl. d. D. Malak. Ges. vol. 37, 1905, p. 109, pl. 2 A, f. 3a-c.

The specimens, somewhat diverse diameter of the shell, differ also rather strongly in sculpture; a few smaller shells are decidedly more finely striate, the larger however are costulate; since however both forms agree in shape of shell and mouth, a division into two species is scarcely to be thought of.

*Spanish Species.*8. *C. ACUS* (Pfeiffer).—Pl. 50, fig. 7.

Shell very small, subimperforate, acicular, plicate-striate under a lens, hyaline; spire subulate, the apex rather obtuse. Whorls 7 to 8, convex, the last less than one-fourth the total length, rounded basally; columella subplicate. Aperture a little oblique, oblong; peristome simple, unexpanded, the columellar margin very narrowly reflexed. Length 3.75, diam. 0.75, aperture 0.66 mm. (*Pfr.*)

Spain: Seville (*Pfr.*).

Bulimus acus *PFR.*, P. Z. S. 1852, p. 60; Monogr. iii, p. 395; Conchyl. Cabinet p. 256, pl. 69, f. 12-14; *cf.* ANCEY, Journ. de Conchyl. lii, 1904, p. 302.—*Cælestele lævigata* *BGT.*, Descr. Cœl. p. 12 (1880).—*C. castroiana* *BGT.*, Descr. Cœl. p. 13.—*C. hispanica* *BGT.*, Descr. Cœl. p. 14.

This species is common in the drift debris of the Guadalquivir at Seville, the type locality of the several alleged species included in the above references. Bourguignat ignores Pfeiffer's species *acus*, and bases three on what seem to be merely slight differences due to individual variation and age. Ancey was the first to recognize a *Coilostele* in *Bulimus acus*. Coutagne (*Comptes Rendus* 1904, p. 1522) seems to think that the ribbed and smooth Spanish species may be a Mendelian mixture or dimorphic species, but gives no reasons for such belief.

9. *C. SERVAINI* Bourguignat.

Shell imperforate, elongate-scalariform, slightly tapering, elegantly striate, the striæ regular, rather thick and slightly obsolete; hyaline, glassy. Spire long, gradually tapering to the obtuse summit. Whorls 7 to 8, the upper ones convexly rounded, the rest scalariform, very much swollen above around the suture, regularly and slowly increasing, the last a little convex, slightly larger. Aperture very oblique, oblong, narrowed above, rounded below, slightly subangular at the base of the columella. Peristome unexpanded, slightly thickened, and indistinctly spreading; columellar margin straight, thick-

ened above, robust, dilated, sublamellose within; margins joined by a rather strong callus. Length 4, diam. 1 mm. (*Bgt.*).

Spain: drift of the Guadalquivir at Seville.

Cælestele servaini Bgt., Descr. Cæl. p. 16, 1880.

Var. *tumidula* Bourguignat.

This species is characterized by a ventricose, slightly obese, scarcely scalariform shape, the whorls convex, a little swollen around the upper part. In *tumidula* the not very regular striæ which are not oblique but nearly vertical, are here and there a little stronger. The swollen, slightly obese shape distinguishes it well from *servaini*, which is lanceolate-scalariform with a deep suture. Length 3.5, diam. 1 mm. Guadalquivir river at Seville. (*Bgt.*).

C. tumidula Bgt., Descr. Cæl., p. 17.

10. *C. LETOURNEUXIANA* Bgt.

Quite recognizable by the lanceolate-acuminate shape, with its whorls convex, deeply separated by a deep suture without being scalariform; its aperture elongate, narrowed, the columella with a large, spirally descending fold within. Elegantly ribbed, the ribs oblique, regularly spaced, disappearing at the summit. Length 4, diam. 1 mm., whorls 8 or 9. (*Bgt.*).

Spain: Guadalquivir at Seville.

Cælestele l., Bgt., Descr. Cæl. p. 18.

Var. *raphidia* Bgt.

Very distinct from the preceding, notably by its more acuminate shape, different costulation (elegantly costate, the ribs strong, oblique, regularly spaced, smaller on the upper whorls, evanescent at the summit), semi-spheric aperture, rounded only on the outer side, and nearly straight from the upper insertion of the lip to the base of the columella; the columella with no appearance of a fold, etc. Length 4, diam. 1.25 mm., whorls 8 to 9. Guadalquivir at Seville. (*Bgt.*).

C. raphidia Bgt., Descr. Cæl., p. 19.

*Mexican Species.*11. *C. TAMPICOENSIS* (Pilsbry). Pl. 20, fig. 1.

See p. 24, where this species was described as a doubtful *Spiraxis*. It is apparently nearest to the Spanish *C. letourneuxiana*, but differs from that by the distinctly though narrowly expanded peristome (that of *letourneuxiana* being said to be simple and unexpanded in specimens a little larger than *tampicoensis*). The expansion of the lip leaves, with subsequent growth, one or two narrow varices on the last whorl, in the largest shells.

The question of whether this Mexican species is an importation from Spain, or is really indigenous, awaits the actual comparison of specimens. It is now abundant in the drift debris of the Panuco river, together with many small native species.

APPENDIX TO ACHATINIDÆ.

Genus OBELISCUS Beek.

The following species should be inserted in Vol. XVIII, p. 271, before *Pseudobalea*.

Subgenus DOLICHOLESTES Pilsbry.

Dolicholestes PILS., Man. of Conch. xviii, p. 266, for *Achatina dunkeri* Pfr. (Oct. 2, 1906).

Shell imperforate, narrowly turritate, smooth and glossy, without varix-lines, composed of 9 or 10 nearly flat whorls. Summit obtuse, rounded and smooth. Aperture small, columella spirally twisted, prominent in the middle, the edge excised or concave above and below the prominence. Internal axis very slender and straight in the earlier whorls, slightly sinuous in the penult and strongly so in the last whorl.

Reproduction viviparous, the embryonic shell smooth, glossy, with round summit and $2\frac{1}{2}$ whorls, the columella excised below, similar to that of the adult form.

The radula of *O. toussaintianus* has 35,1,35 teeth of Stenogyryne structure. Central teeth very small, with a single small cusp. Lateral teeth tricuspid, the mesocones long. Marginal teeth tricuspid, with a broad mesocone and minute side cusps. (Pl. 25, fig. 6, *O. toussaintianus*).

Type *O. dunkeri* Pfr.; distribution, Haiti.

Dolicholestes differs from *Obeliscus* by its sinuous columella, and the brilliant gloss of the shell. In the structure of the columella it resembles the Oriental genus *Tortaxis*. *Sigmataxis* differs chiefly by its delicate, rather glassy shell, marked with grooves and varix-lines.

Mr. W. G. Binney figured the teeth of "*Spiraxis dunkeri* Pfr." as of the aculeate type, and similar to those of *Streptaxidæ* (Ann. N. Y. Acad. Sci. iii, p. 82, pl. 17, f. κ). I have copied his figure on plate 25, fig. 3. It was this which caused me to refer the group to the *Oleacinidæ* (Man. of Conch. xviii, p. 266). On examining the radula of *O. toussaintianus* I find that it is typically Stenogyroid. This species is so closely related to *O. dunkeri* in shell characters that they must surely belong to one and the same genus; and I am thus forced to believe that the radula figured by Binney for *dunkeri* was some other form.

The embryonic young of *O. toussaintianus* are similar to *O. (Stenogyra) terebraster* (Vol. xviii, pl. 37, fig. 103), but with wider spire and less impressed suture.

1. *O. DUNKERI* (Pfeiffer). Pl. 5, figs. 1, 2, 3.

Shell turrite, rather thin, smooth, pellucid, glossy, tawny. Spire elongate, the apex obtuse; suture impressed, margined, obsoletely crenulate. Whorls 9, slightly convex, the last less than one-third the length. Columella arcuate, highly and subvertically truncate. Aperture subtriangular-semioval; peristome simple, the right margin arched forward. Length 28, diam. 7.5, aperture 9 x 4 mm. (*Pfr.*).

Santo Domingo: Tablaso, near San Cristobal (A. Sallé); Cibao region, common, usually living in couples, under dead leaves; Puerto Plata (Hjalmarson).

Achatina dunkeri PFR., P. Z. S. 1851, p. 148; 1855, p. 9;

Conchyl. Cab. p. 344, pl. 37, f. 25, 26; pl. 43, f. 5, 6 (var.); Monogr. iii, p. 500; vi, 190.—*Spiraxis* (*Euspiraxis*) *dunkeri* Pfr., BINNEY, Ann. N. Y. Acad. Sci. i, p. 355, pl. 15, f. n (teeth); Ann. N. Y. Acad. Sci. iii, p. 82, pl. 17, f. κ (teeth).—*Spiraxis d.*, CROSSE, Journ. de Conch. 1891, p. 151.

The very glossy shell is finely, faintly striatulate, with a smooth, rounded apex. It is pale yellow, the earlier whorls paler and corneous, the last whorl indistinctly streaked with darker yellow or tawny. The specimens originally described by Pfeiffer were rather small (fig. 1). Larger ones from Sallé before me, bearing Pfeiffer's label, measure: Length 30, diam. 8 to 8.3, aperture 9.8 mm., whorls 9 to 9½; diameter at second whorl 1.7 mm.

Two of a series from Pto. Plata measure:

Length 32, diam. 7.8, aperture 9.3 mm., whorls 10½.

Length 27.7, diam. 7.5, aperture 9 mm., whorls 9½.

The largest individual before me is one taken by W. M. Gabb, length 38, diam. 9, aperture 11 mm., with 10¾ whorls (pl. 5, fig. 2).

Pfeiffer also described and figured a larger chestnut-colored variety with pale base, length 38, diam. 8 mm., from the Cuming collection (fig. 3).

2. O. TURRITELLATUS (Deshayes). Pl. 5, figs. 4, 5.

Shell turriculate, elongate, narrow at the base, slightly obtuse at the summit, white without markings, smooth, polished, glossy. The spire is formed of 10 slightly convex whorls, the suture is but little impressed and simple. The aperture is very small, a little longer than wide, slightly more than one-fourth the length of the shell. The columella is strongly oblique, recurved in the middle and excised at the base, but obliquely and not so deeply as the majority of the species [of *Achatina*]. The right lip is simple, thin and acute, a little effuse at base. Length 33, diam. 9, aperture 9 mm.

Habitat unknown.

Achatina turritellata DESH., Encycl. Méth. ii, p. 11 (1830); Fér., Histoire ii, pt. 2, p. 167, pl. 134, f. 17, 18.—PFR.,

Monogr. ii, 259. — Cf. BOETTGER, *Nachrichtsblatt D. Malak.-Ges.* 1905, p. 180.

Deshayes states that this species was based upon a single example. His later French description in the *Histoire* contains several obvious errors. It may prove to be identical with *D. dunkeri* Pfr., but no comparison of *dunkeri* with the type of *A. turritellata* has been made. Dr. Boettger has suggested that *A. turritellata* is identical with the West African *Subulina* or *Homorus bacilliformis* (Manual vol. XVII, p. 152), but in that the apex is larger.

The striae as shown in the figures are too emphatic.

3. *O. TOUSSAINTIANUS* n. sp. Pl. 5, fig. 6.

Shell imperforate, turrite, rather solid though thin, dark chestnut, fading to yellow on the spire and whitish at the summit. Surface very glossy, weakly and finely striatulate. Whorls $9\frac{1}{2}$, nearly flat, parted by a linear, slightly serrate suture. Apex rather large, rounded. Aperture subrhombic, slightly oblique, the outer lip thin, somewhat arched forward, columella vertical, prominent in the middle, very obliquely truncate below. In oblique view it is strongly concave above the median prominence. Length 34, diam. 8, aperture 9.9; diam at second whorl 2.2 mm.

Haiti: La Ferrière (Henderson and Simpson).

This species is readily distinguishable from *D. dunkeri* by its much larger summit and early whorls. The cuticle is very dark on the last two whorls. In other features it closely resembles *D. dunkeri*. The largest specimen in the Henderson collection is 37.8 mm. long, 8.7 wide, aperture 10 mm. long, with 10 whorls.

OPEAS SCALARE (Deshayes). Pl. 52, fig. 3.

Shell long-conic, thin, fragile, pellucid, white, pale yellowish. Spire long, the apex rather obtuse, scalariform. Whorls 8, convex, parted by a deep suture, marked with peculiarly sublamellose, appressed longitudinal striae, very minutely granulose under the lens. Last whorl oblong, quite short, tapering downward, having a very small perforation. Aper-

ture small, rather narrow, long-ovate; peristome unexpanded, simple, acute; columellar margin subcylindric, reflexed above, covering the umbilicus. Length 11, diam. 4 mm. (*Desh.*).

China: Pekin and southern Shensi (David).

Bulimus (Stenogyra) scalaris DESH., Nouvelles Archives du Muséum, Bulletin x, 1874, p. 96, pl. 1, f. 27-29.—*Stenogyra s.*, MLLDFF., Jahrb. viii, 42 (Tientsin).

“By its larger size and general shape this species is readily distinguished from *B. chinensis*.” Gredler has suggested that it is *O. subula*. It is more likely to be identical with *O. javanicum* (Vol. 18, p. 138).

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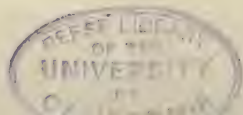
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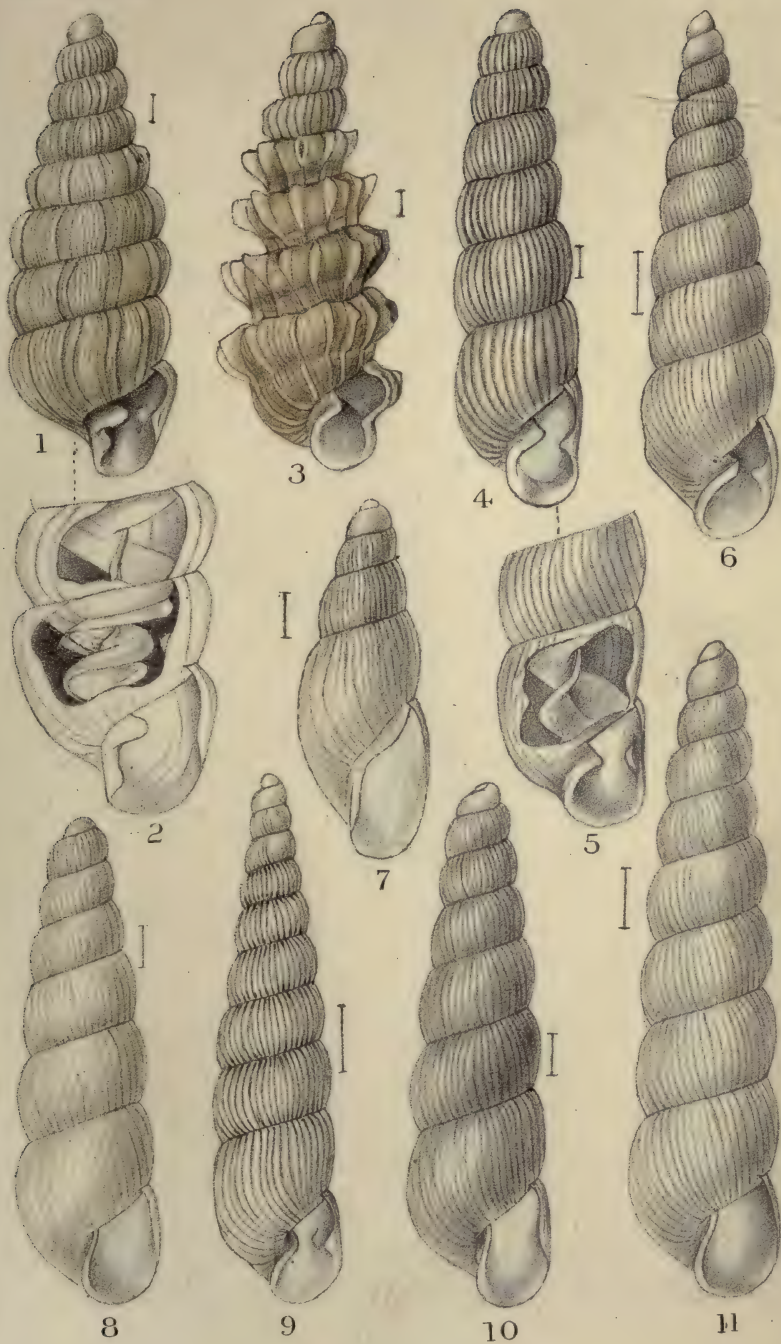
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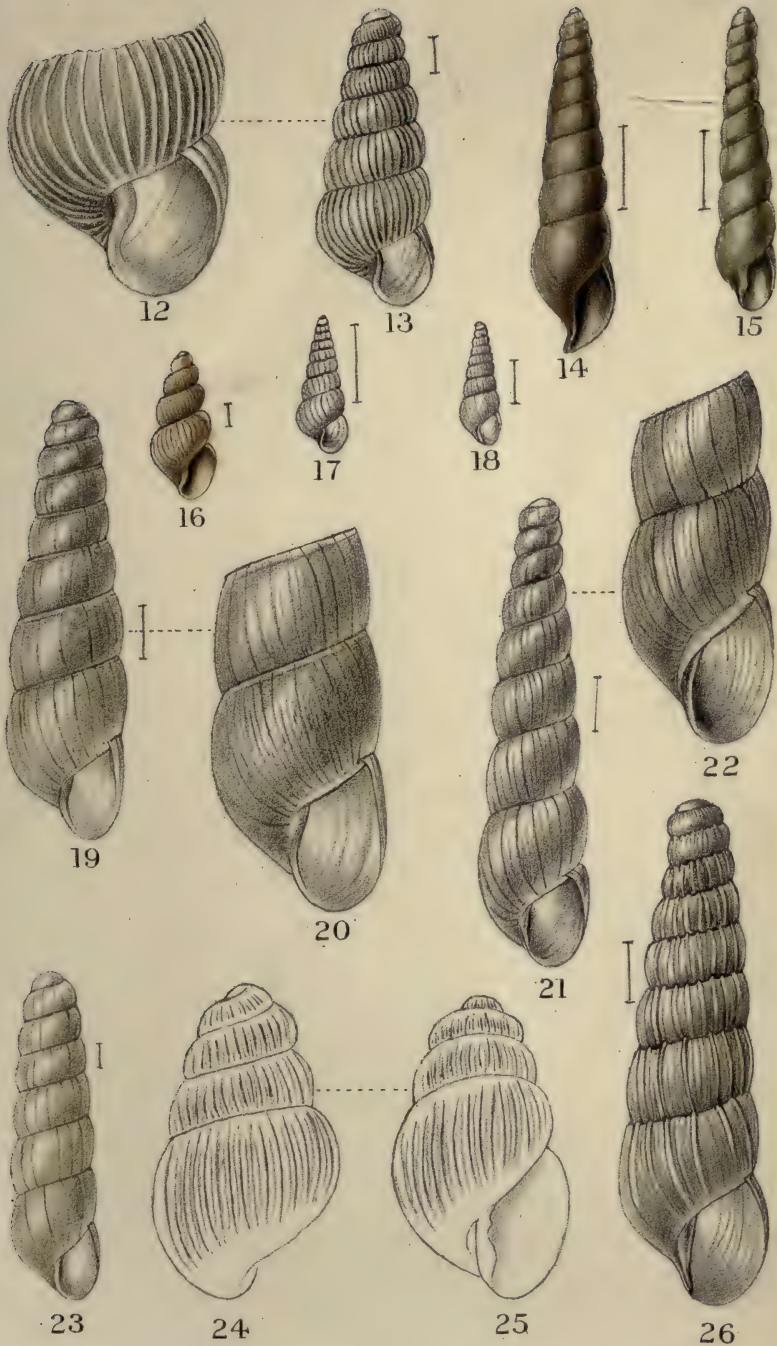
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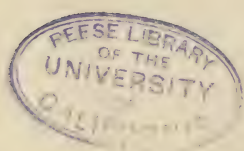
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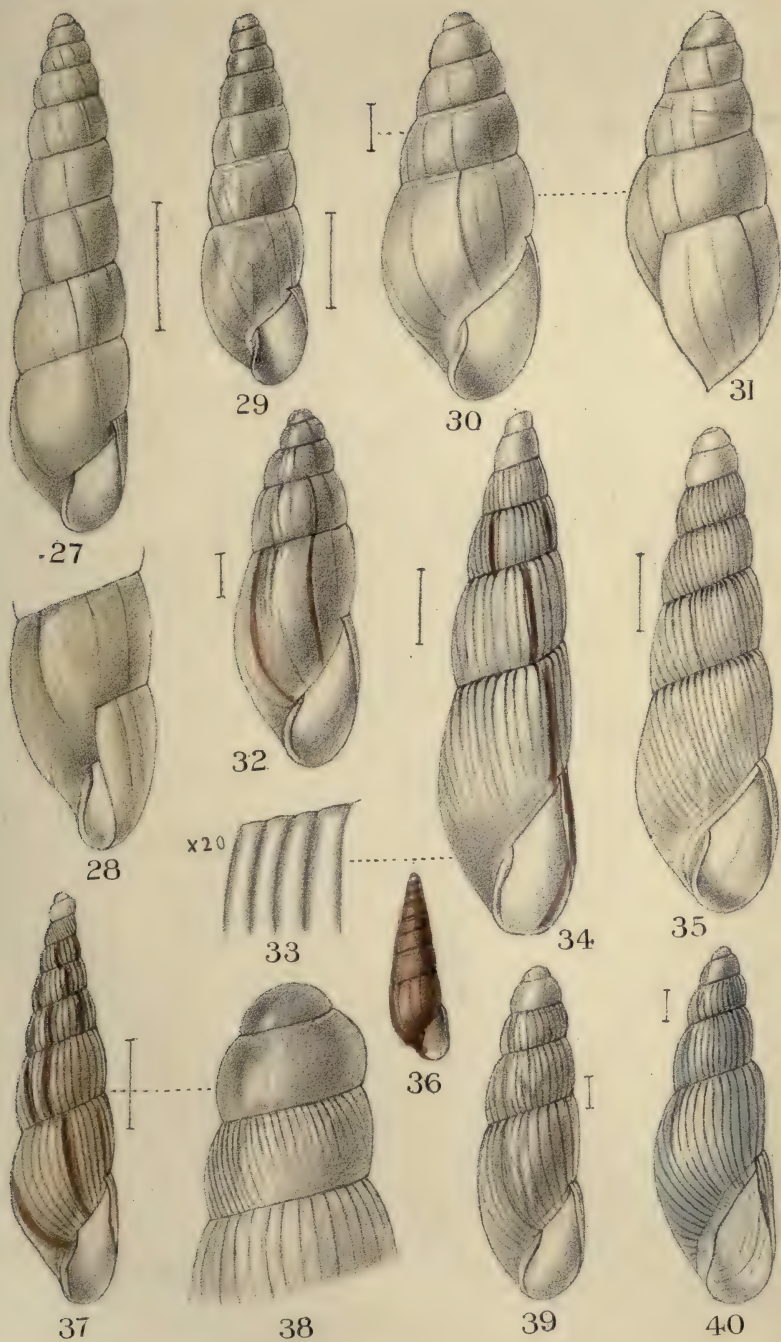




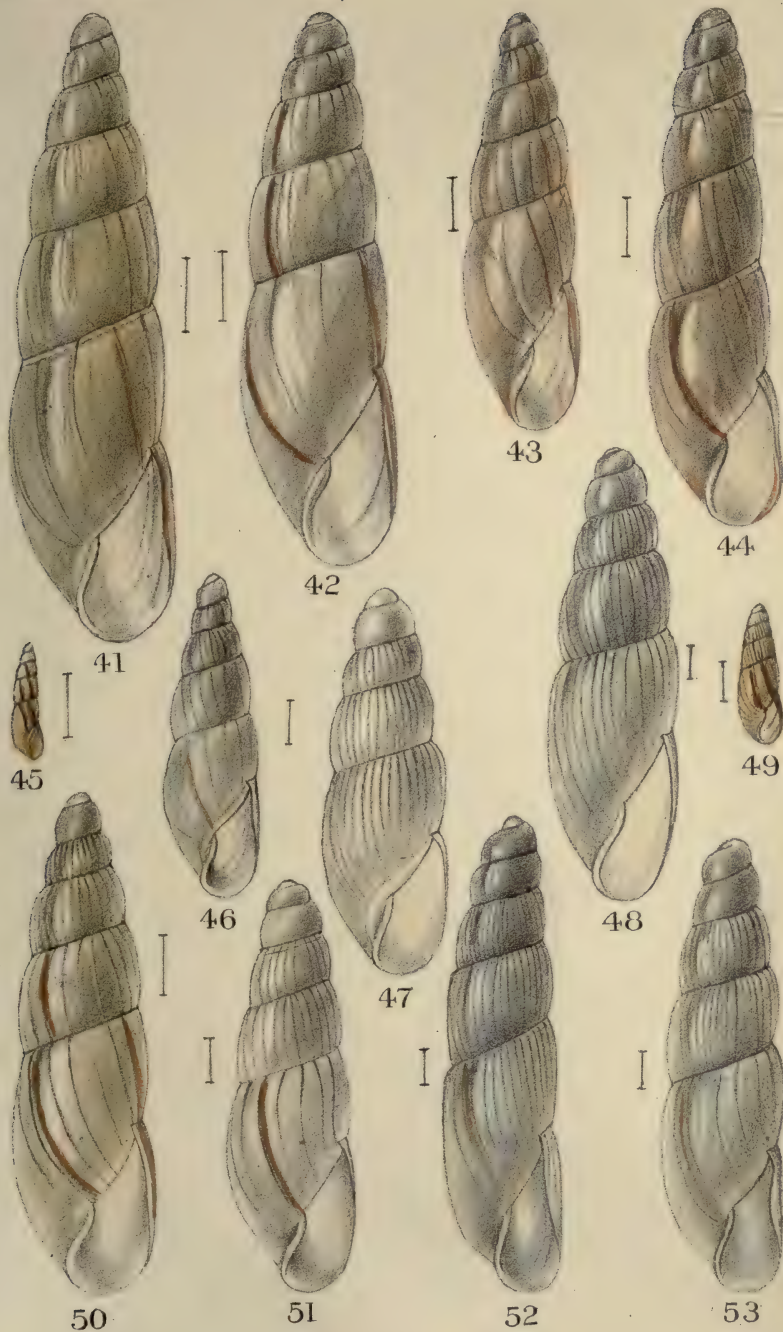








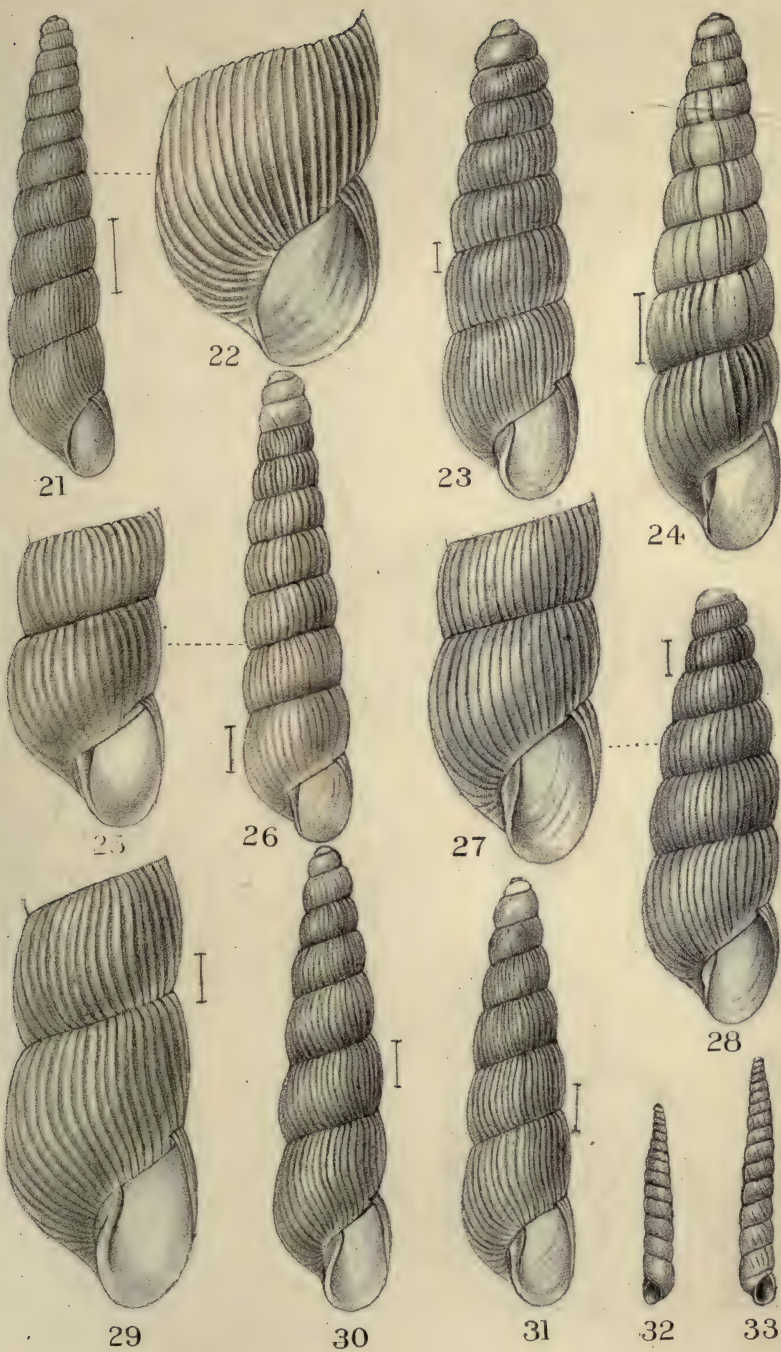




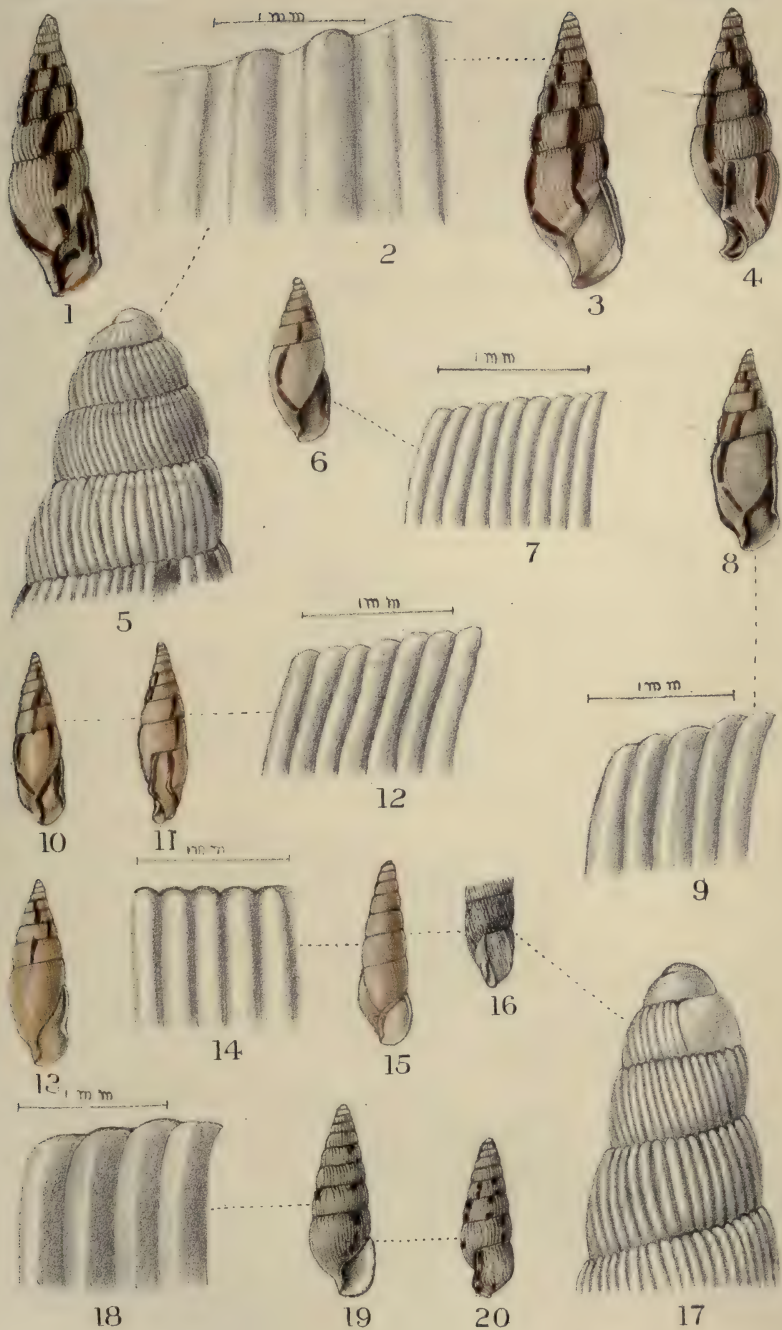




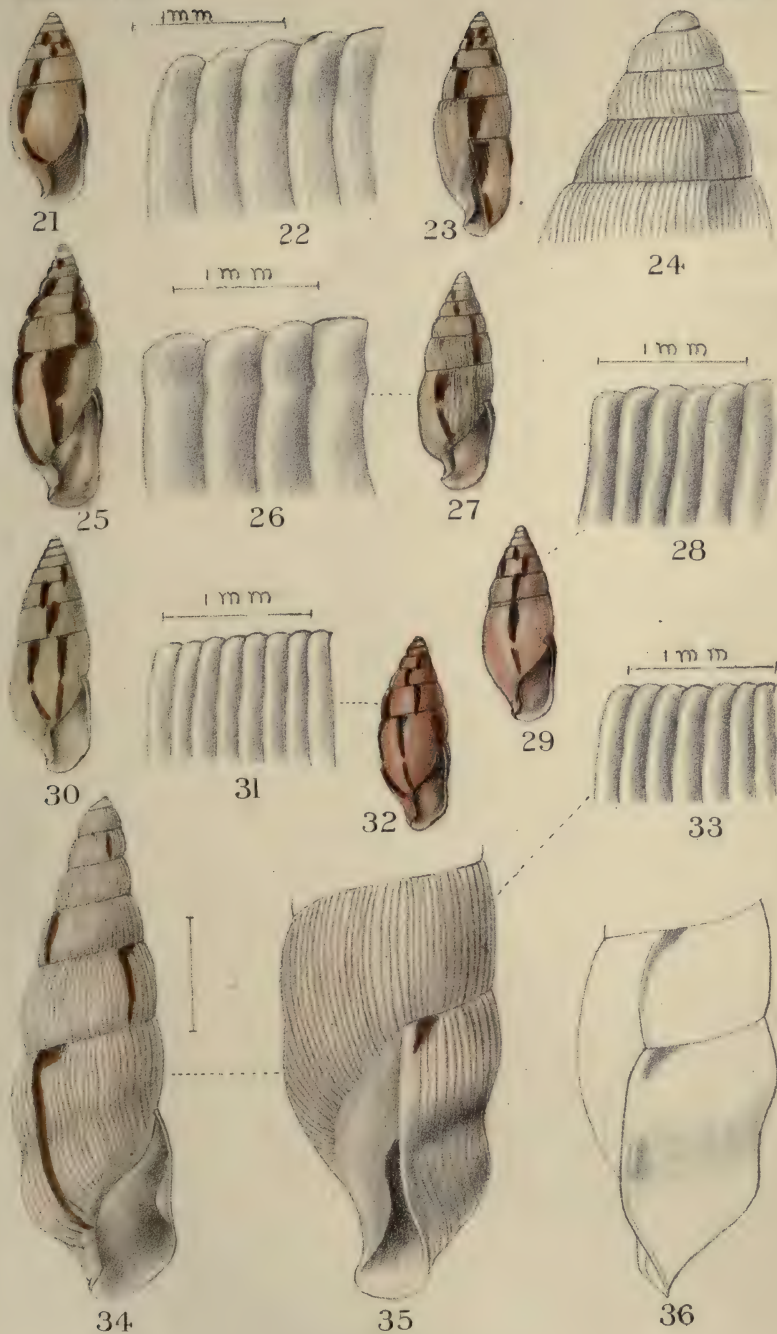




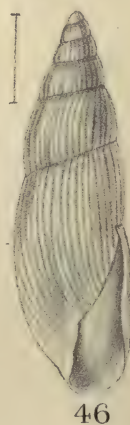
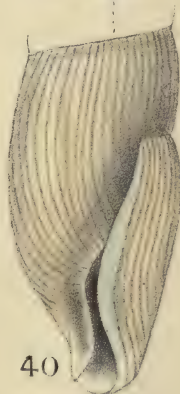
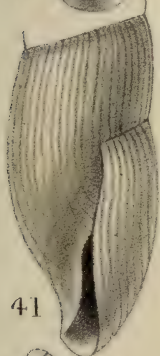




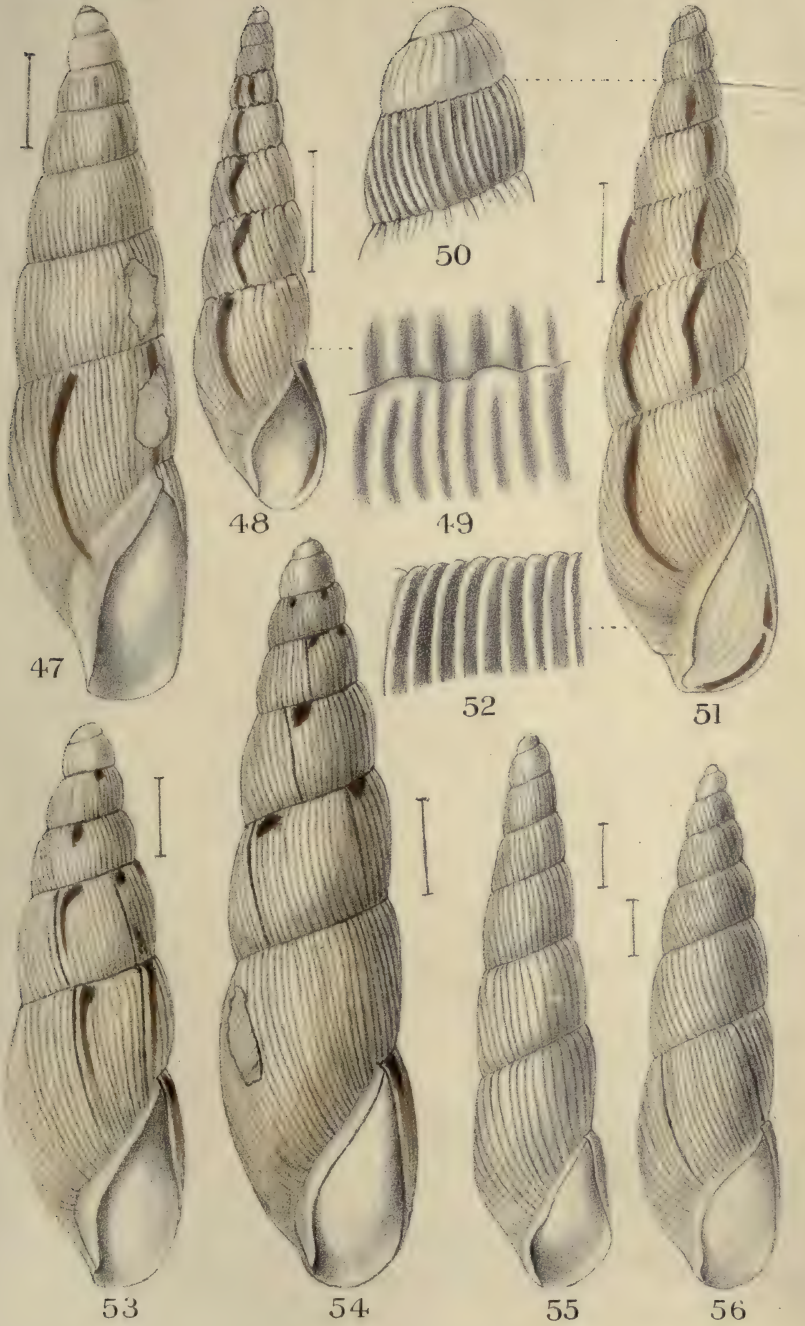




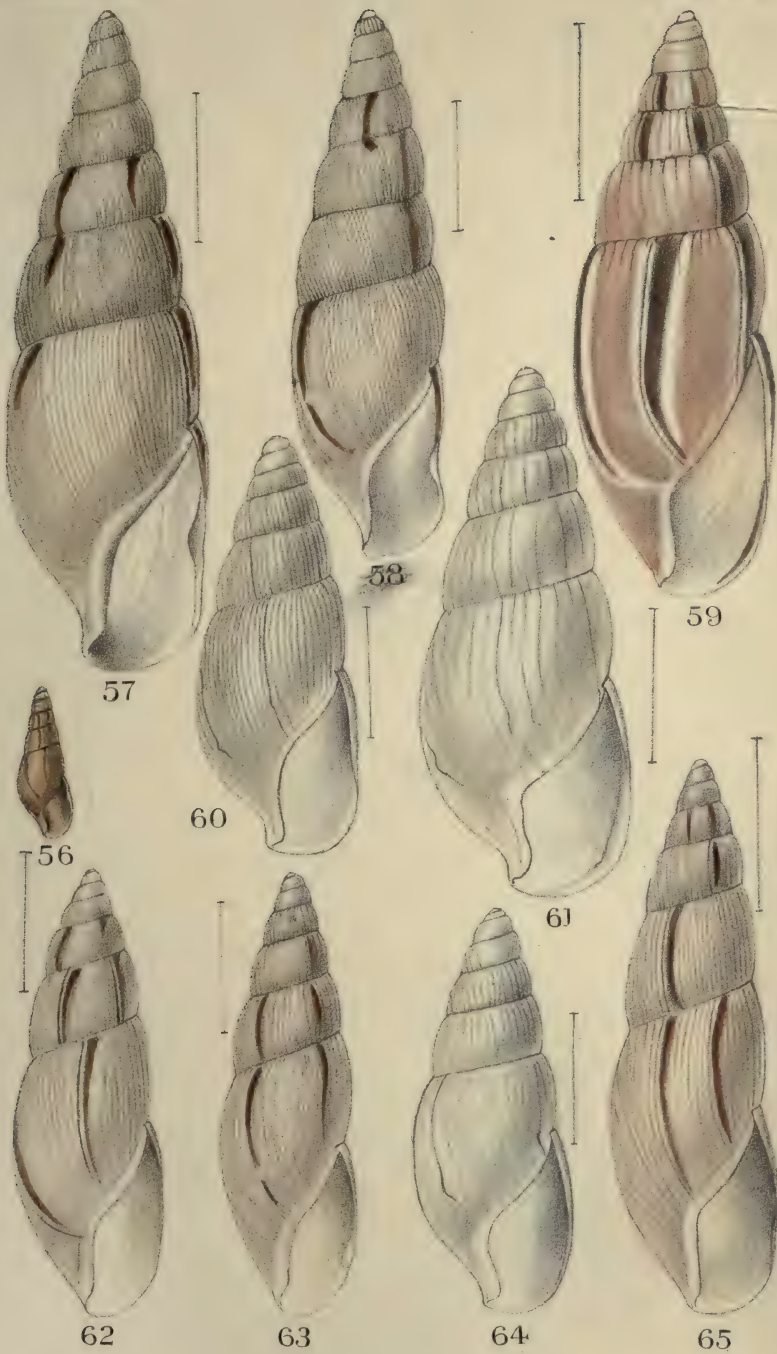


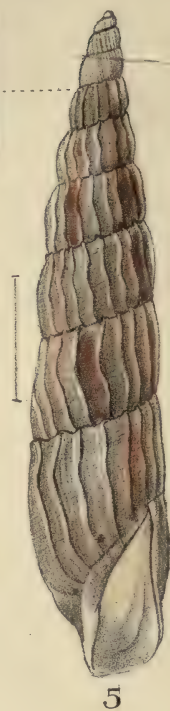
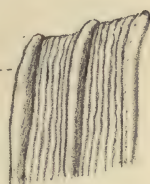
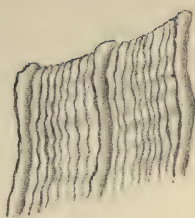
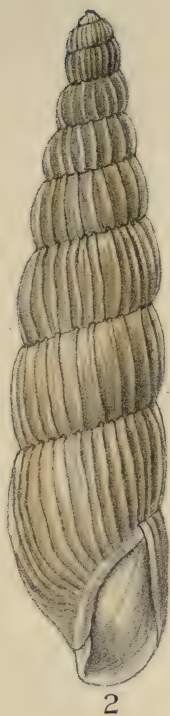




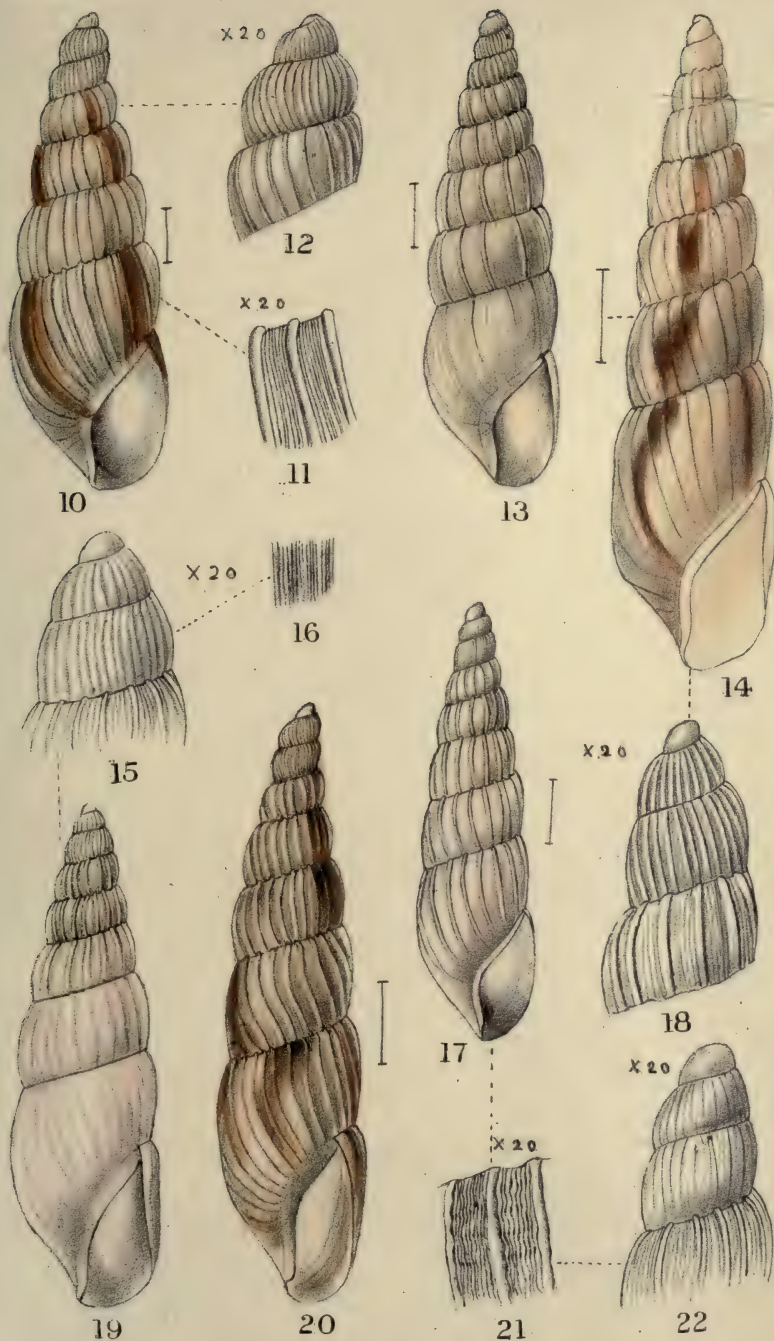




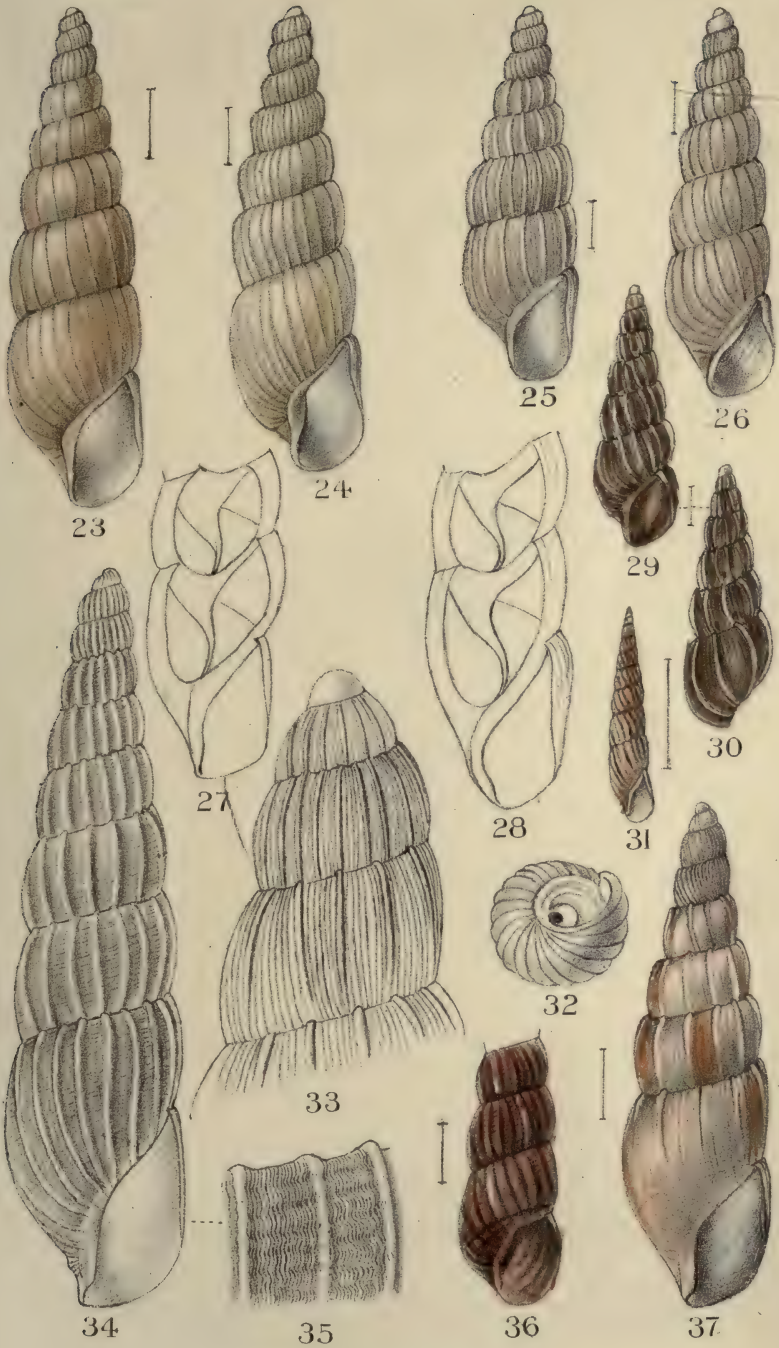




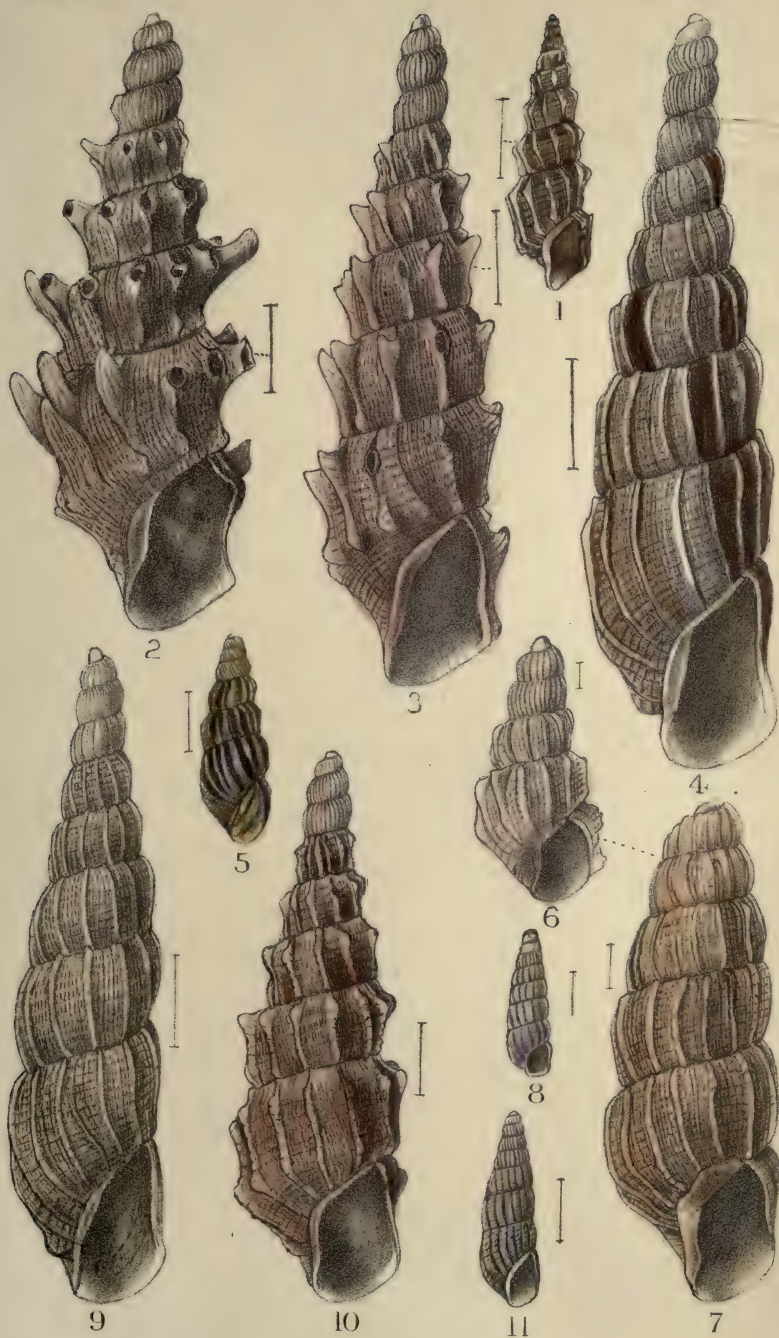




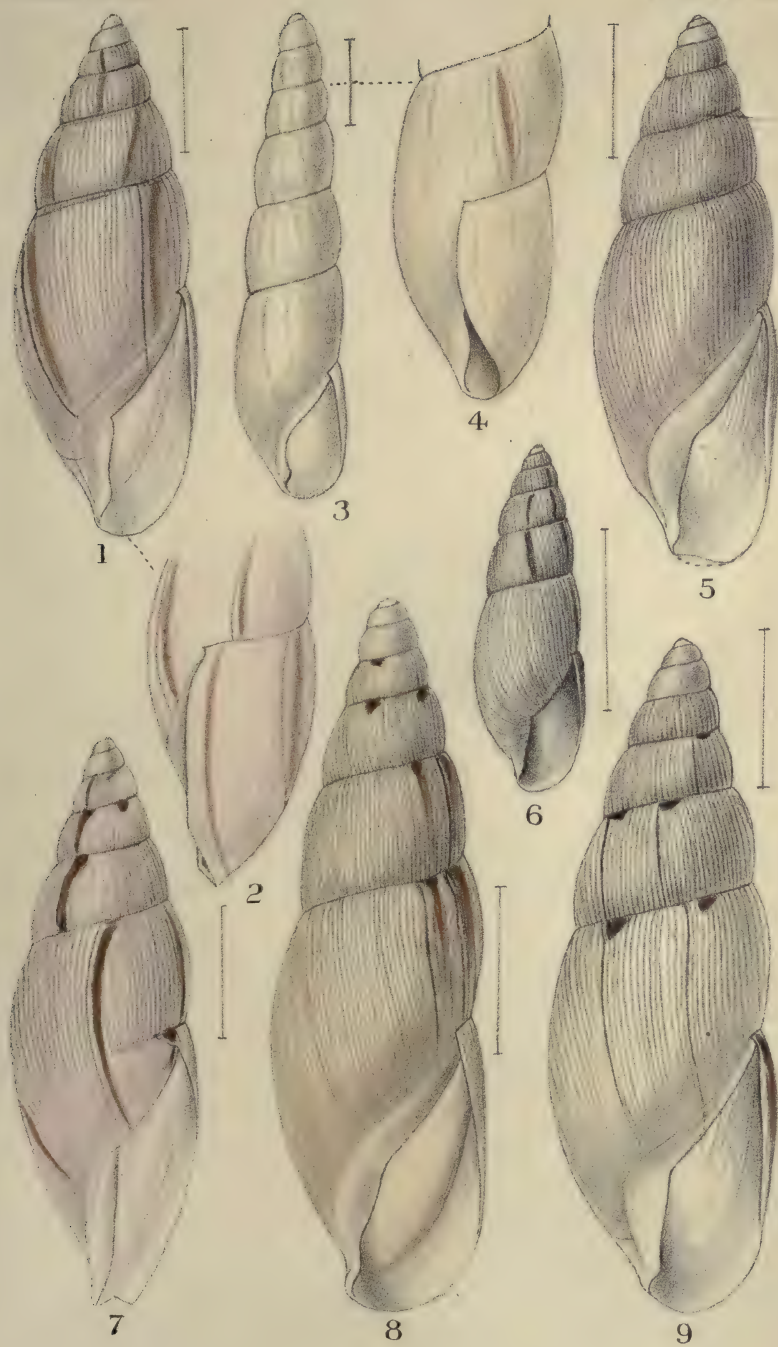








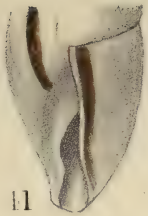








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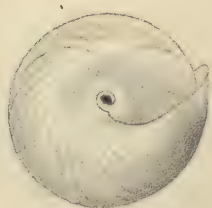
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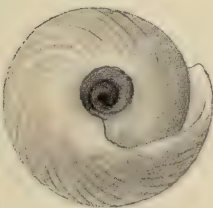
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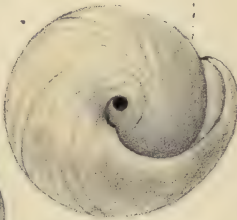
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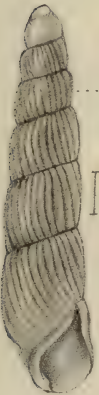
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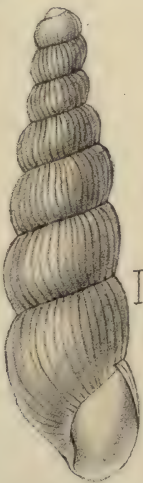
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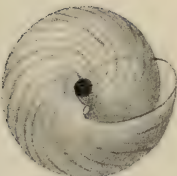
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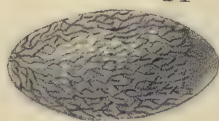
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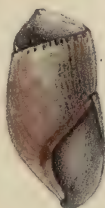
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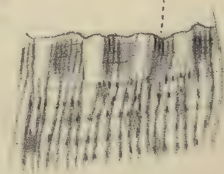
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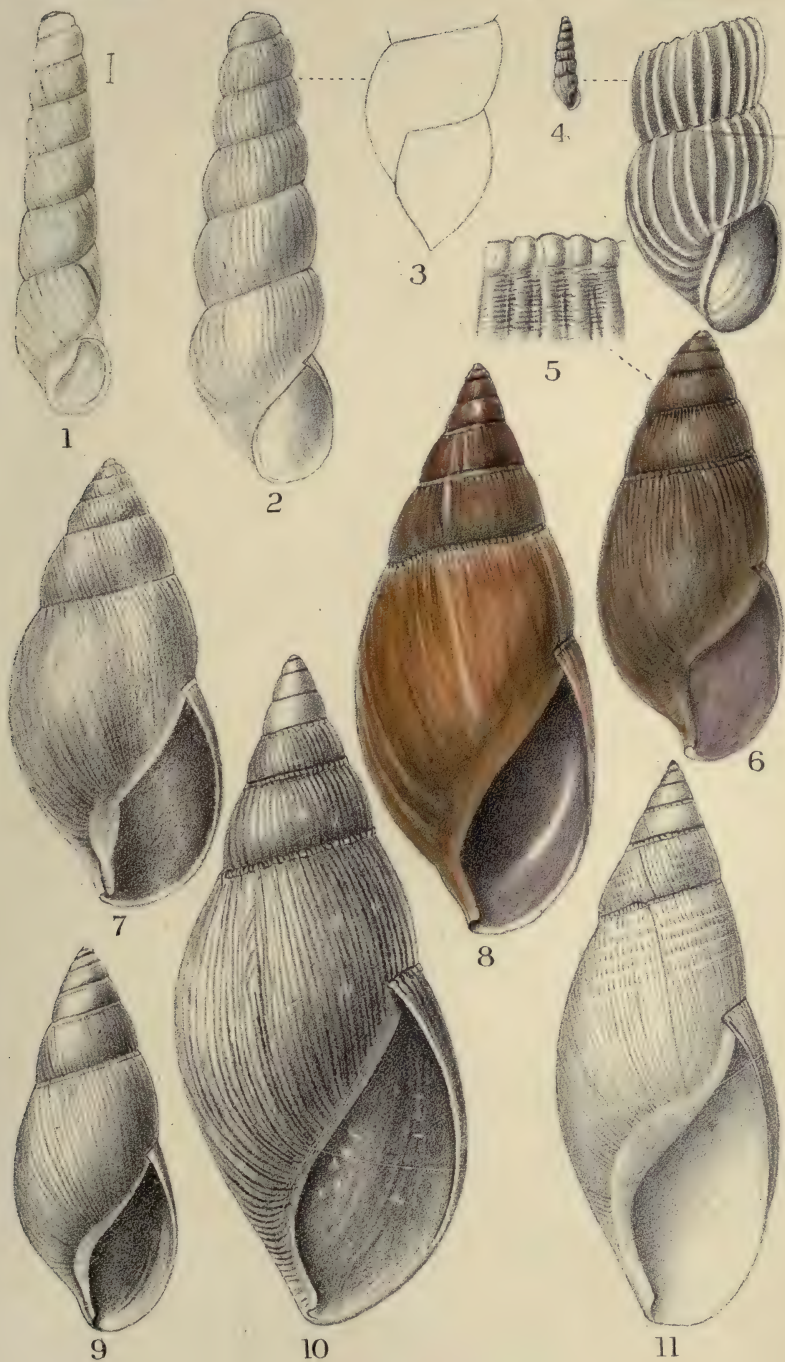


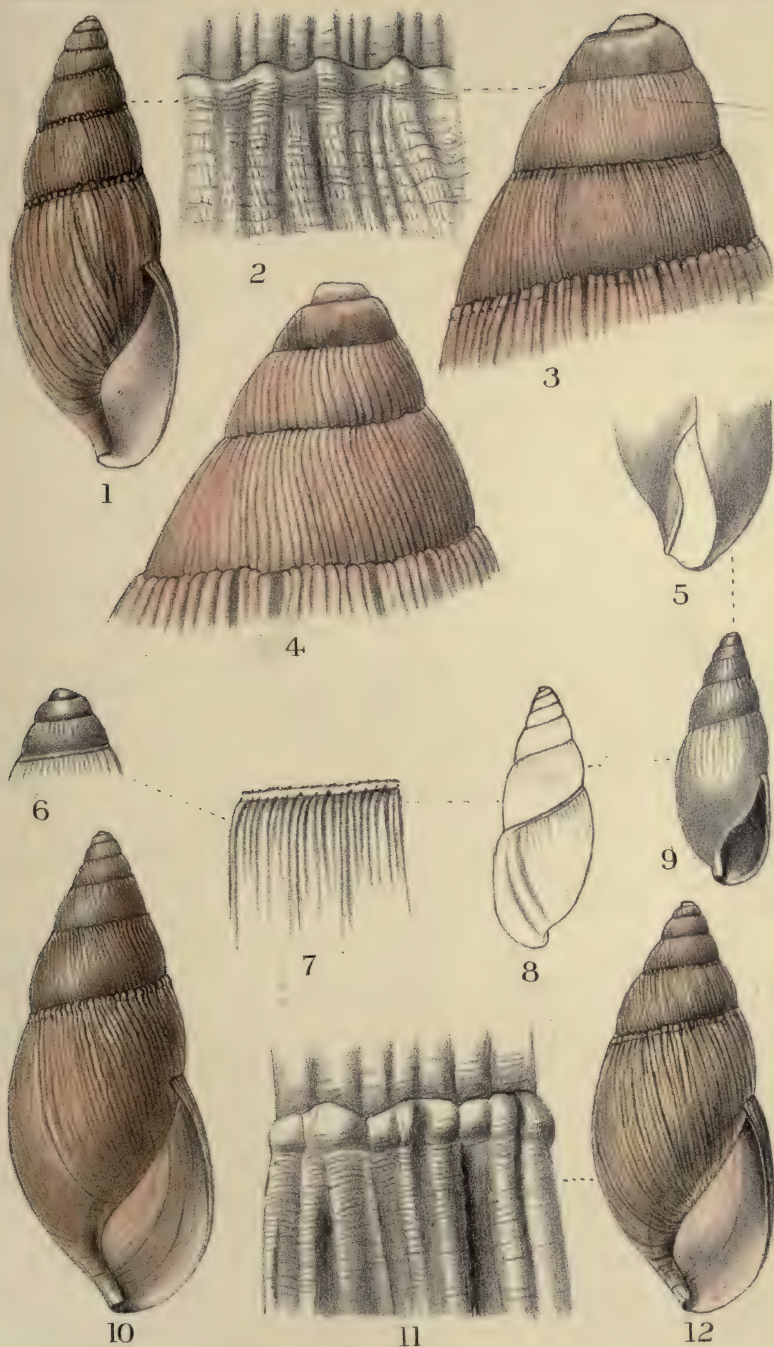
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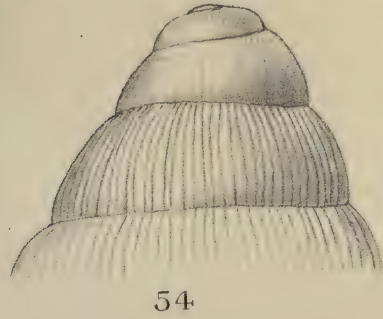
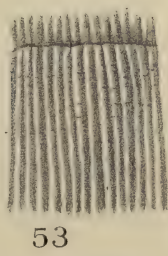
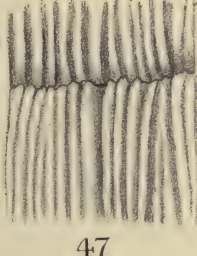
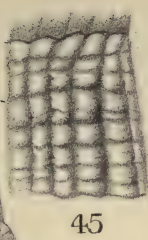
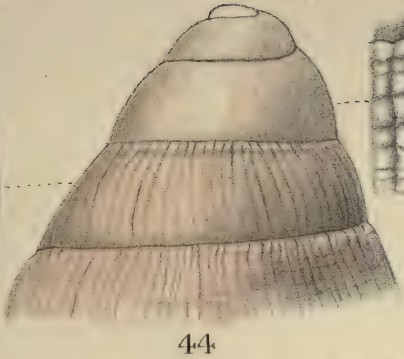


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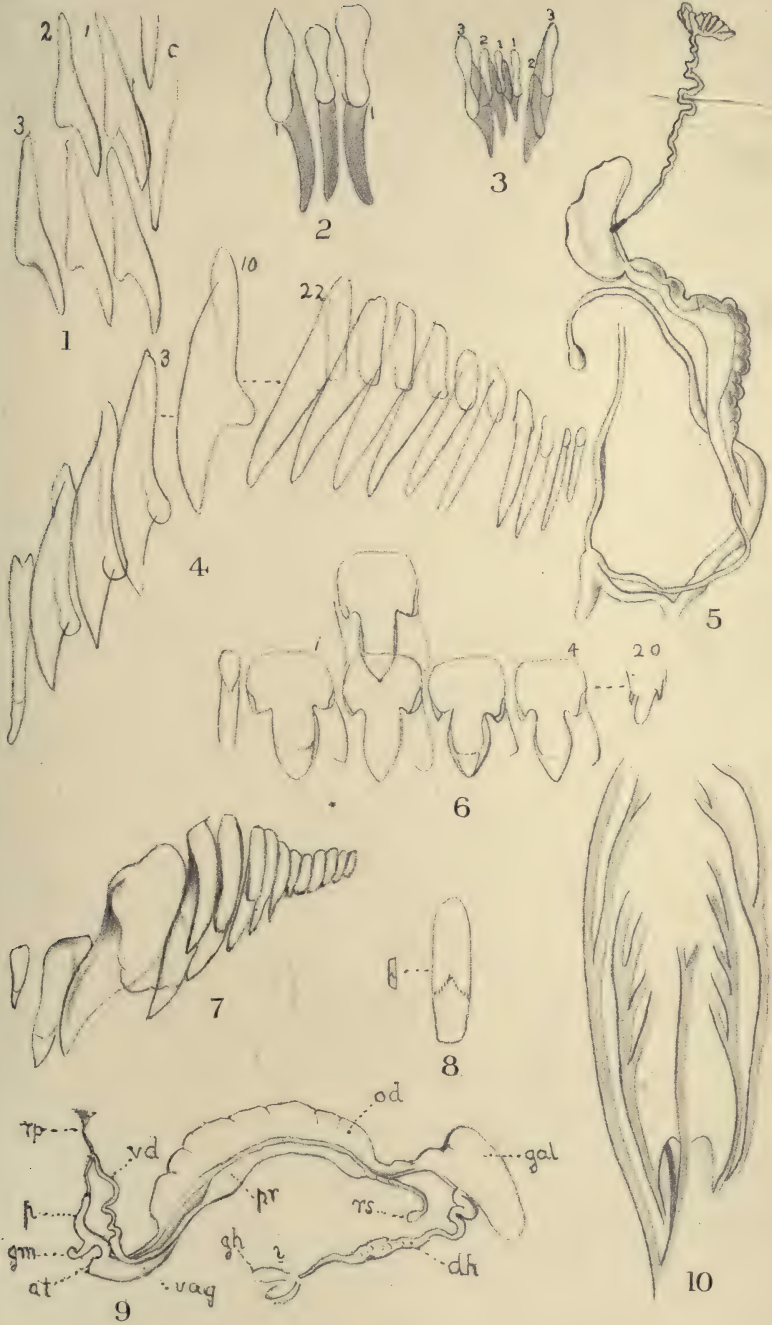
















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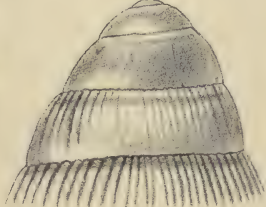
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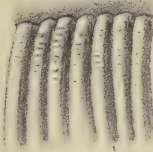
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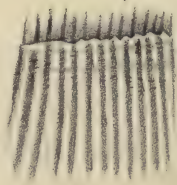
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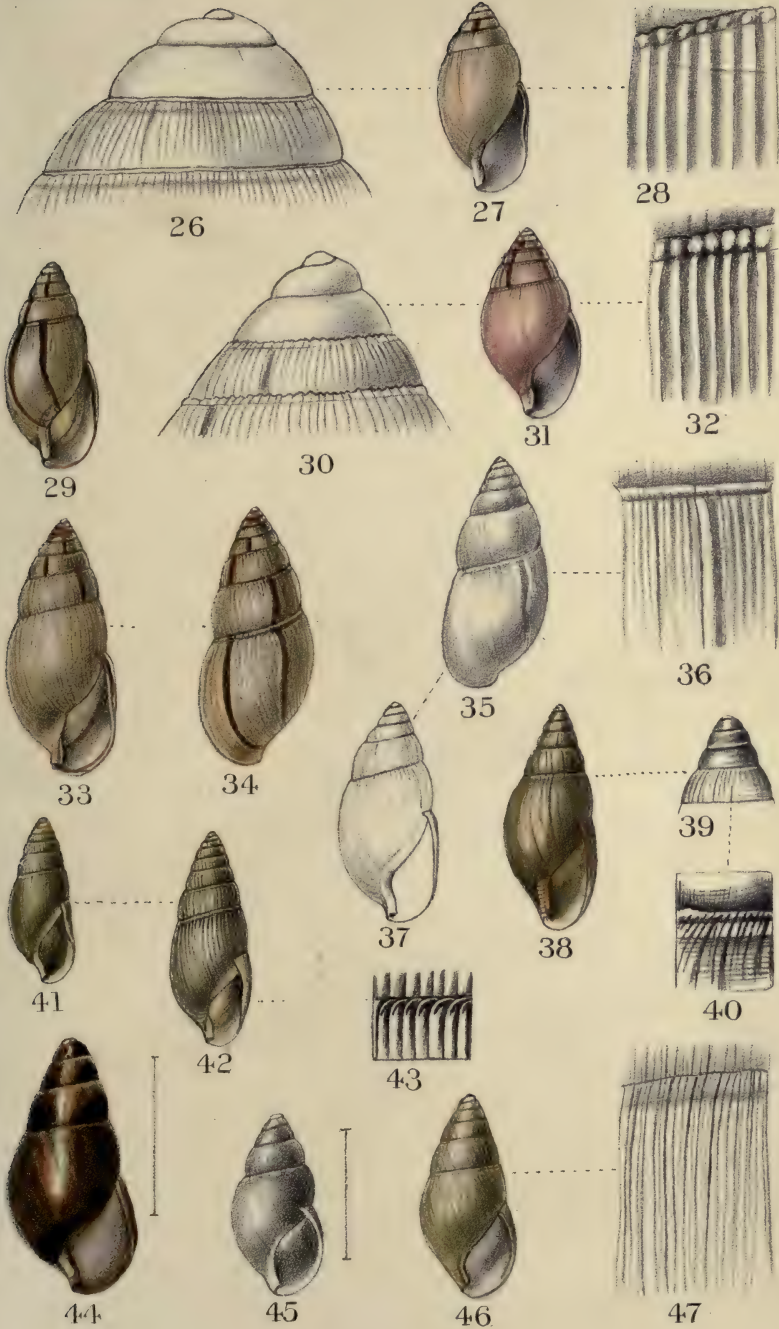
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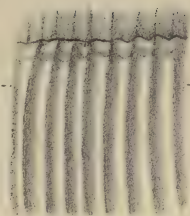


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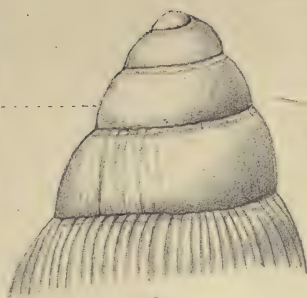




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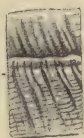
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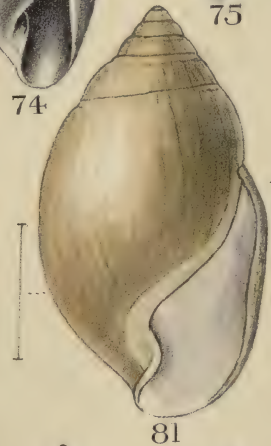
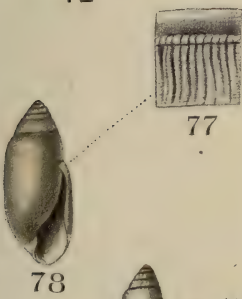
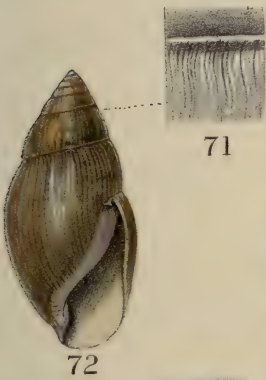
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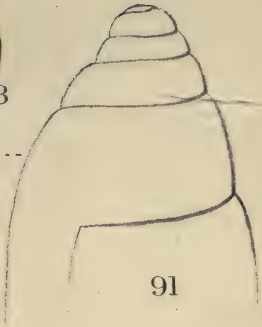
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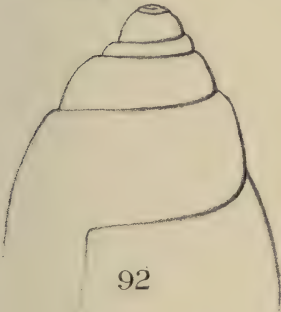
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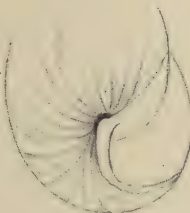
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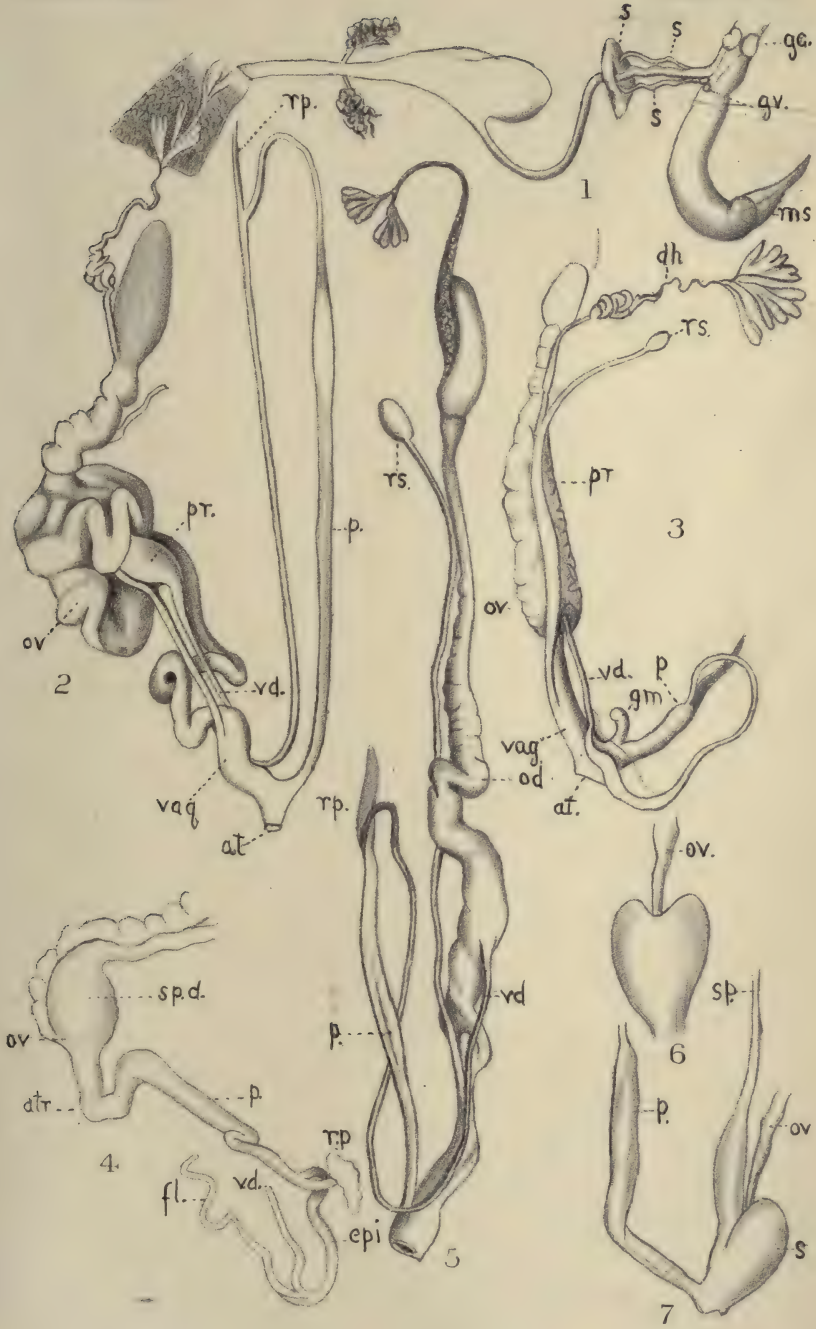




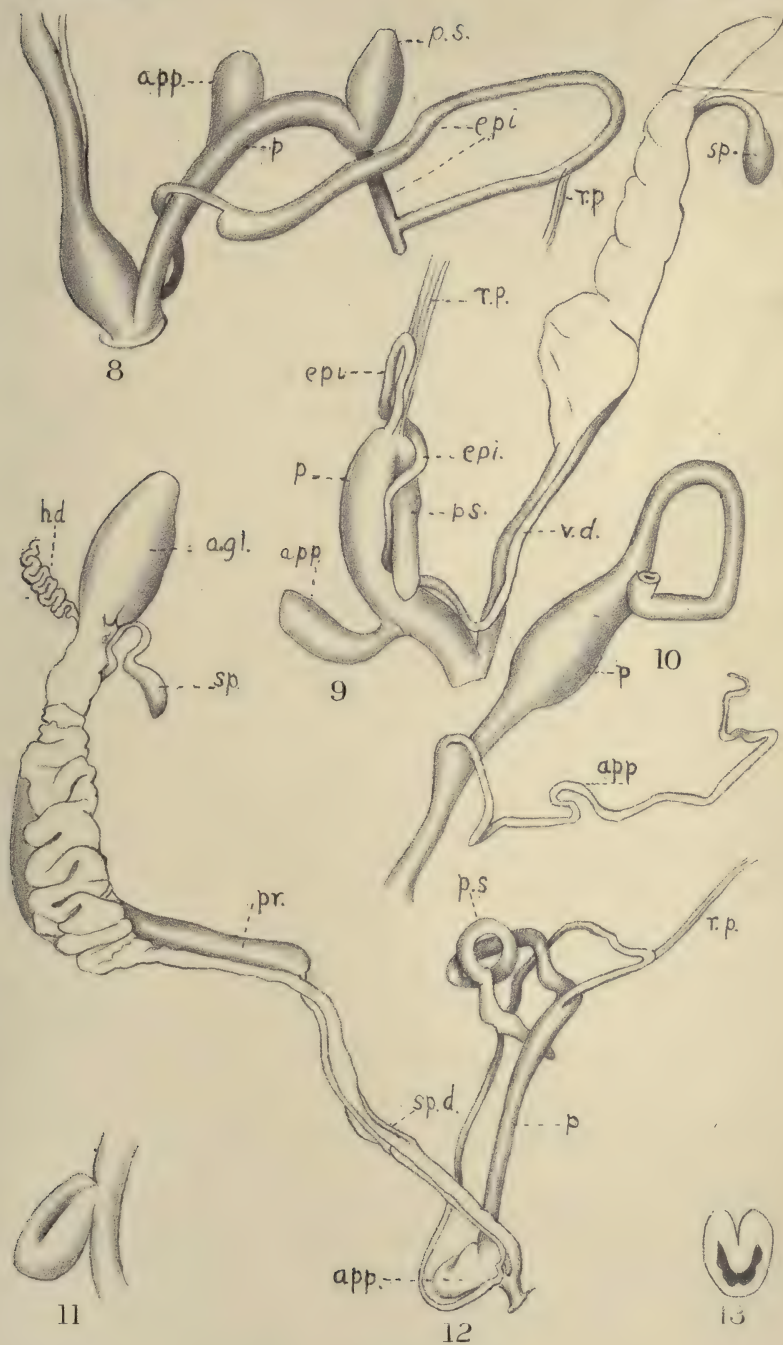




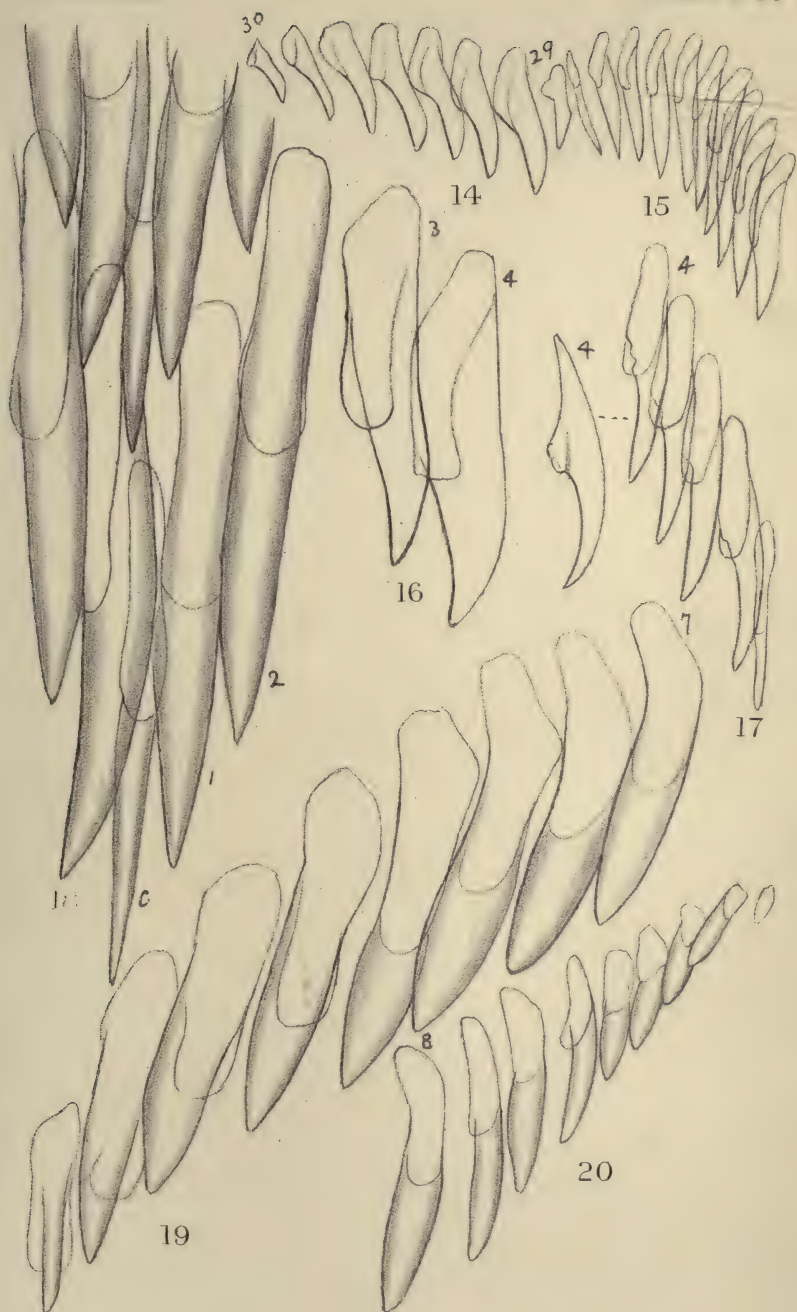




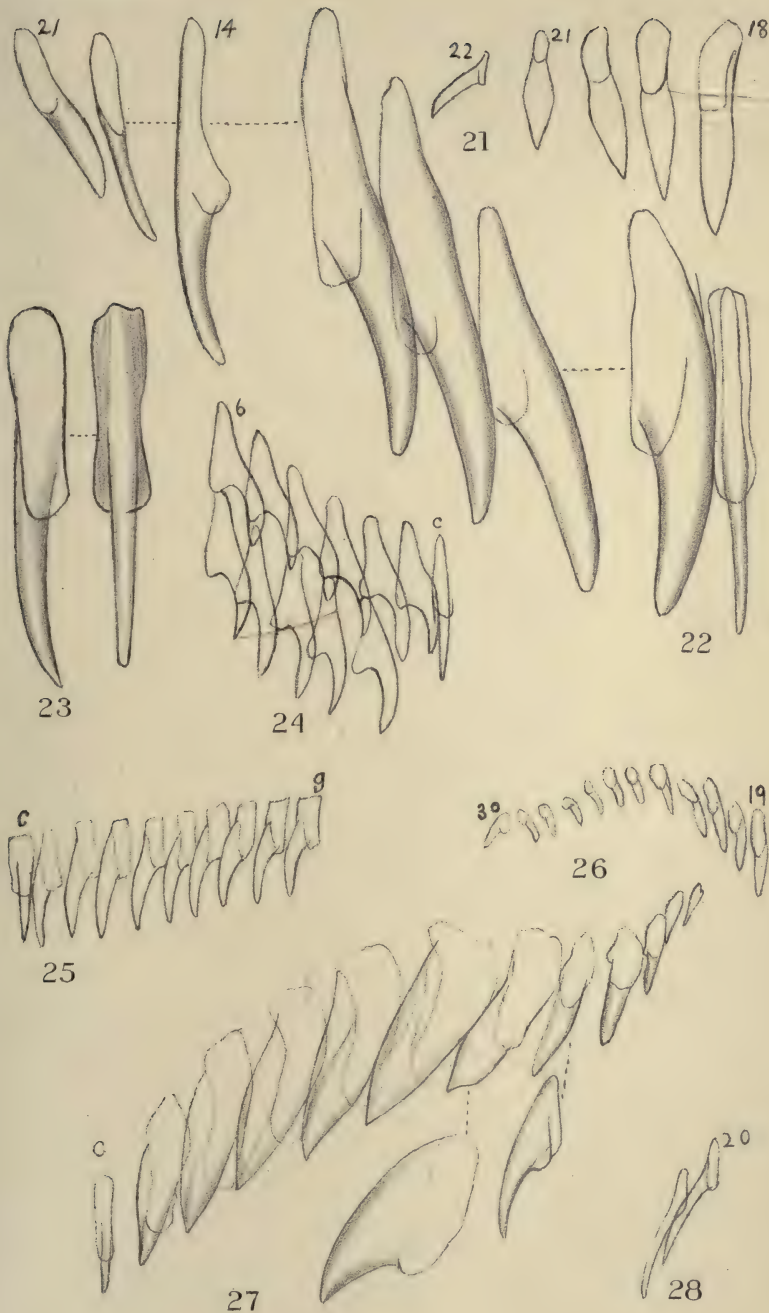




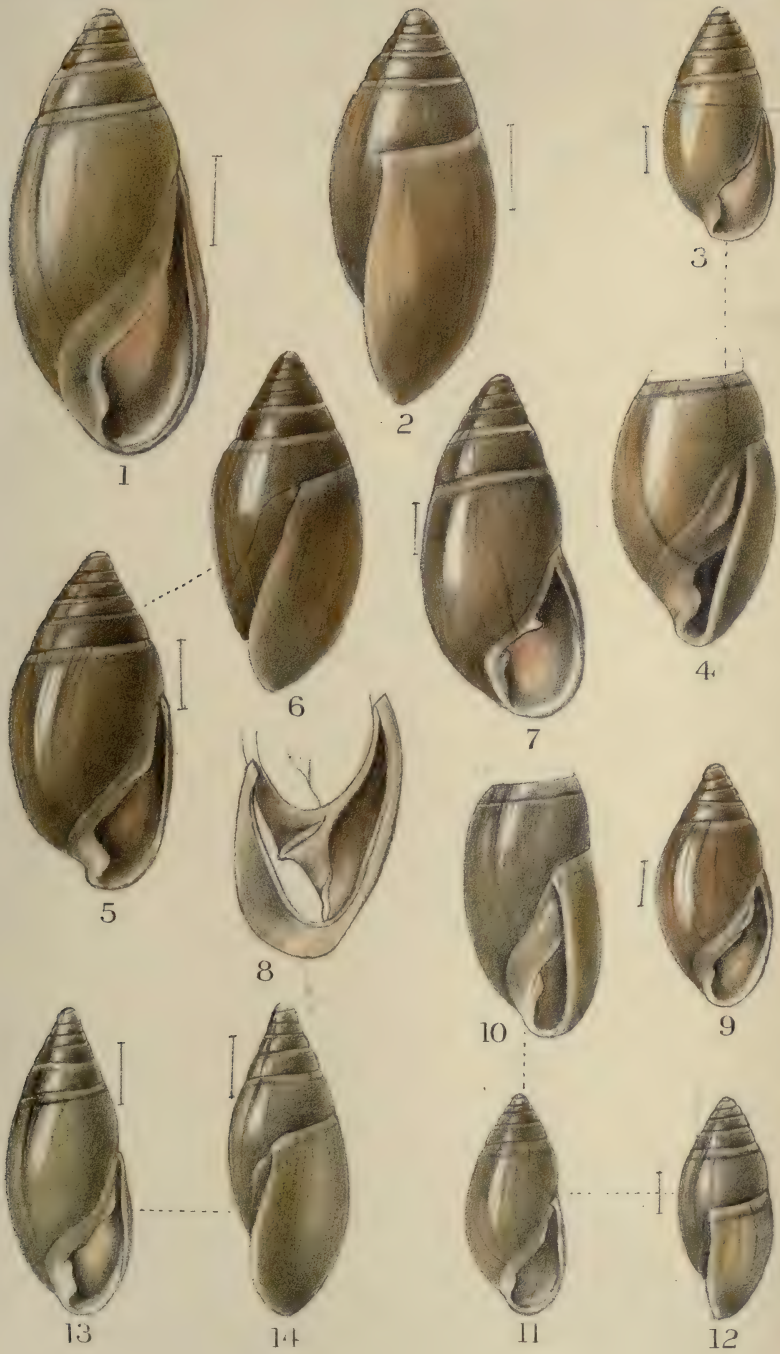
















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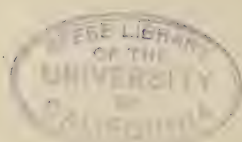
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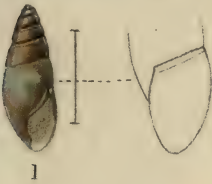


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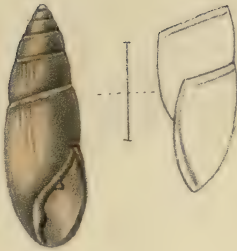




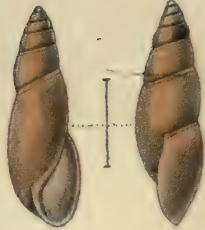




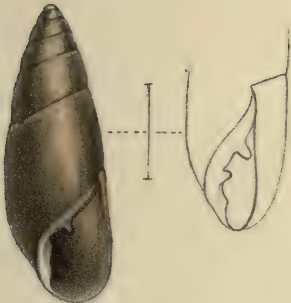
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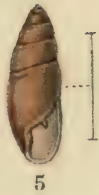
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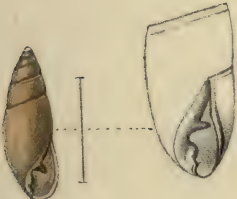
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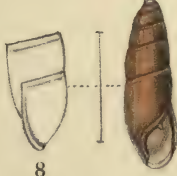
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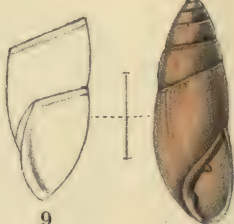
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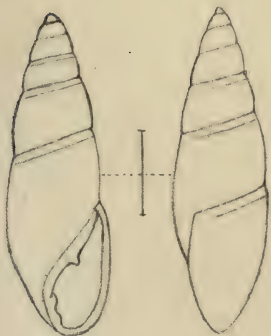
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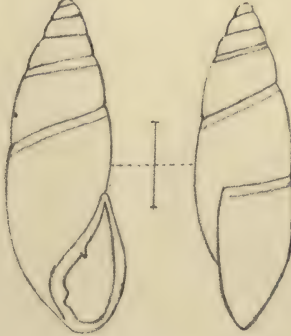
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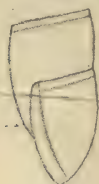


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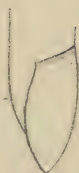
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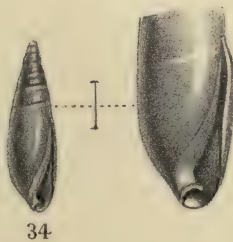
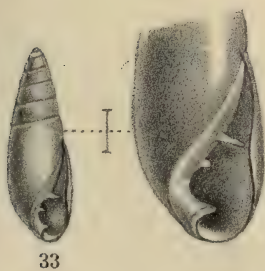
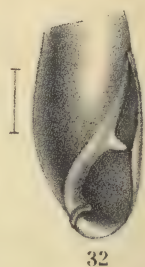
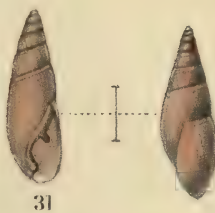
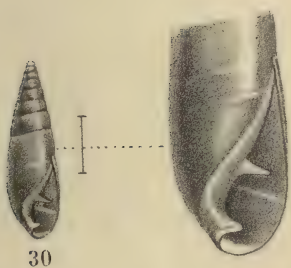
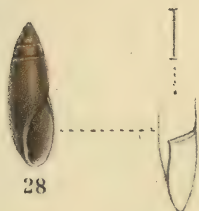
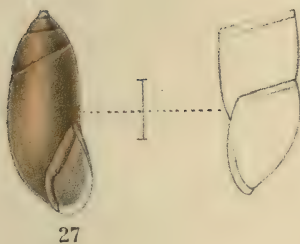
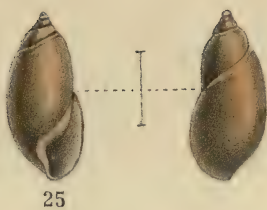
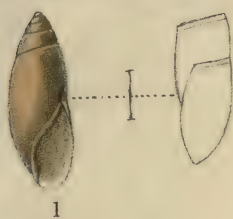


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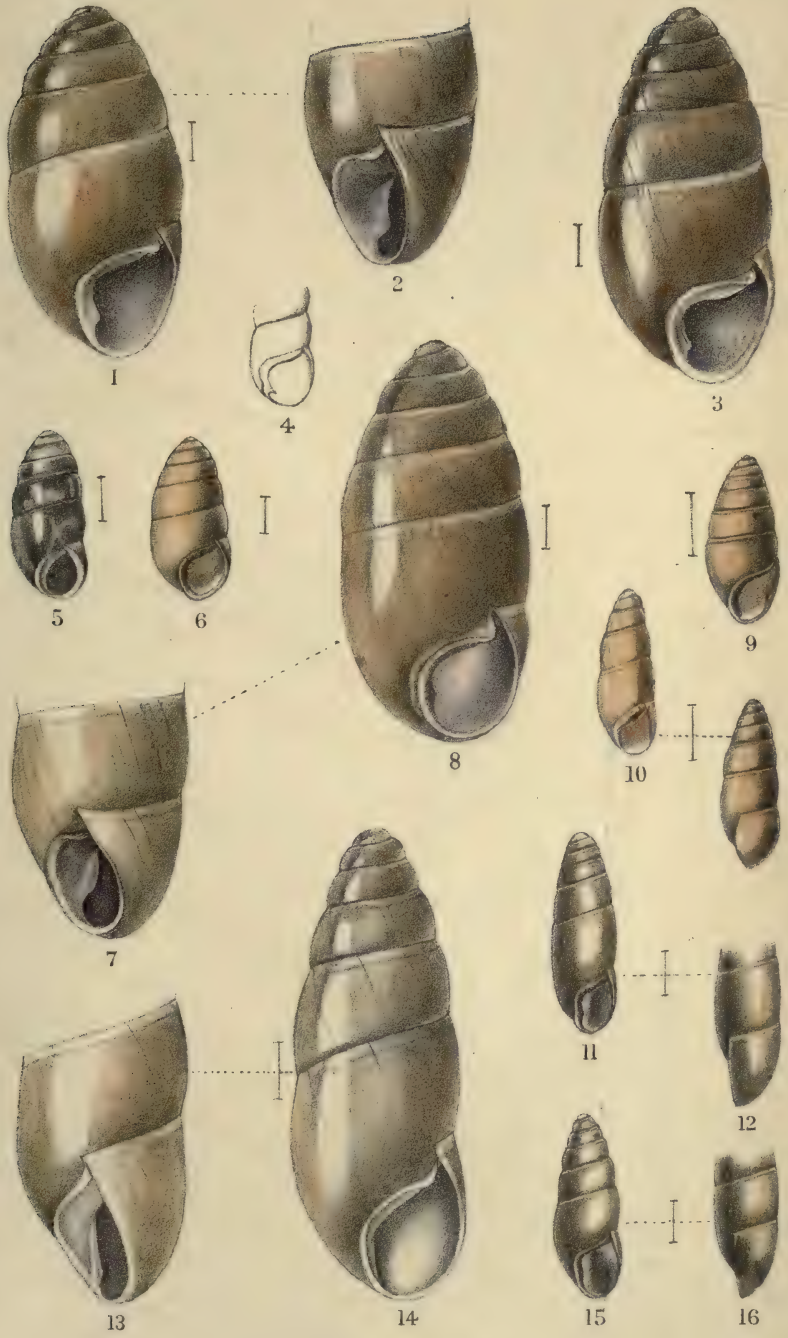
















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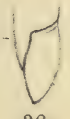
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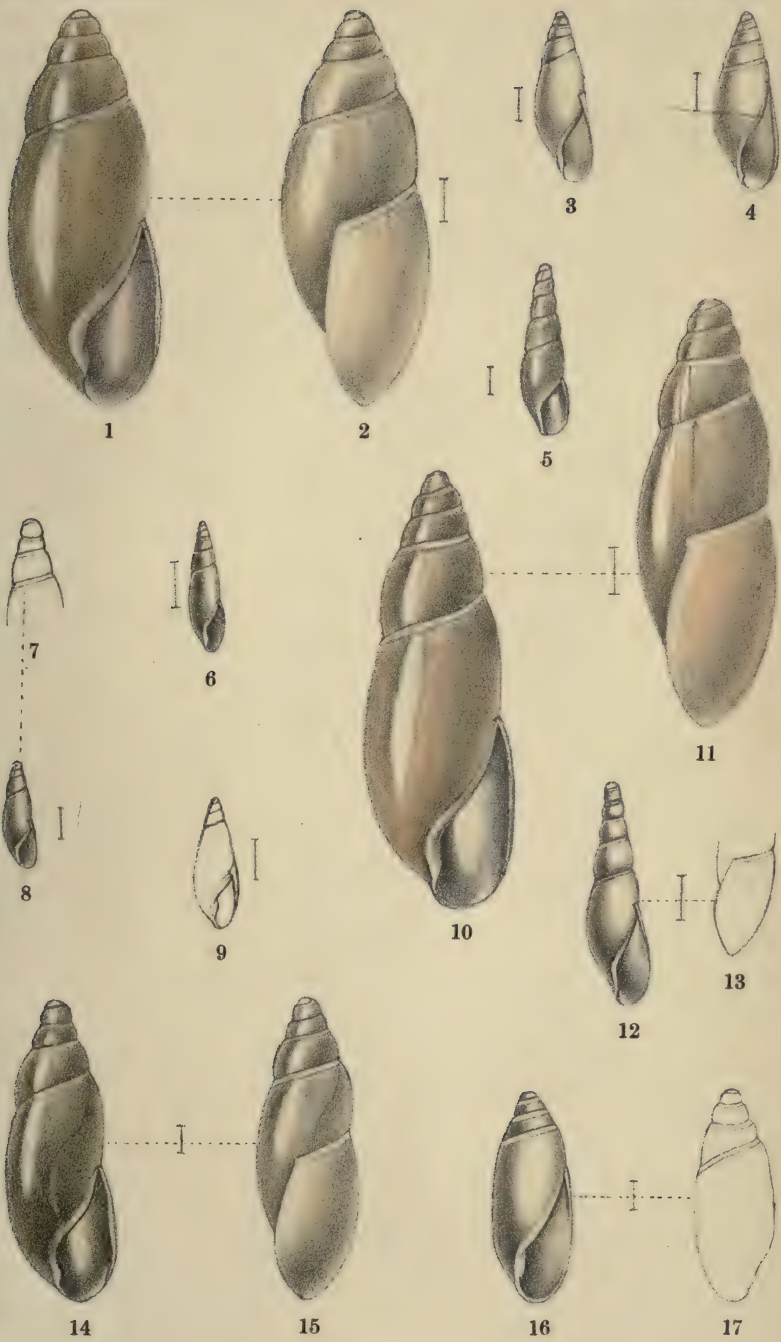
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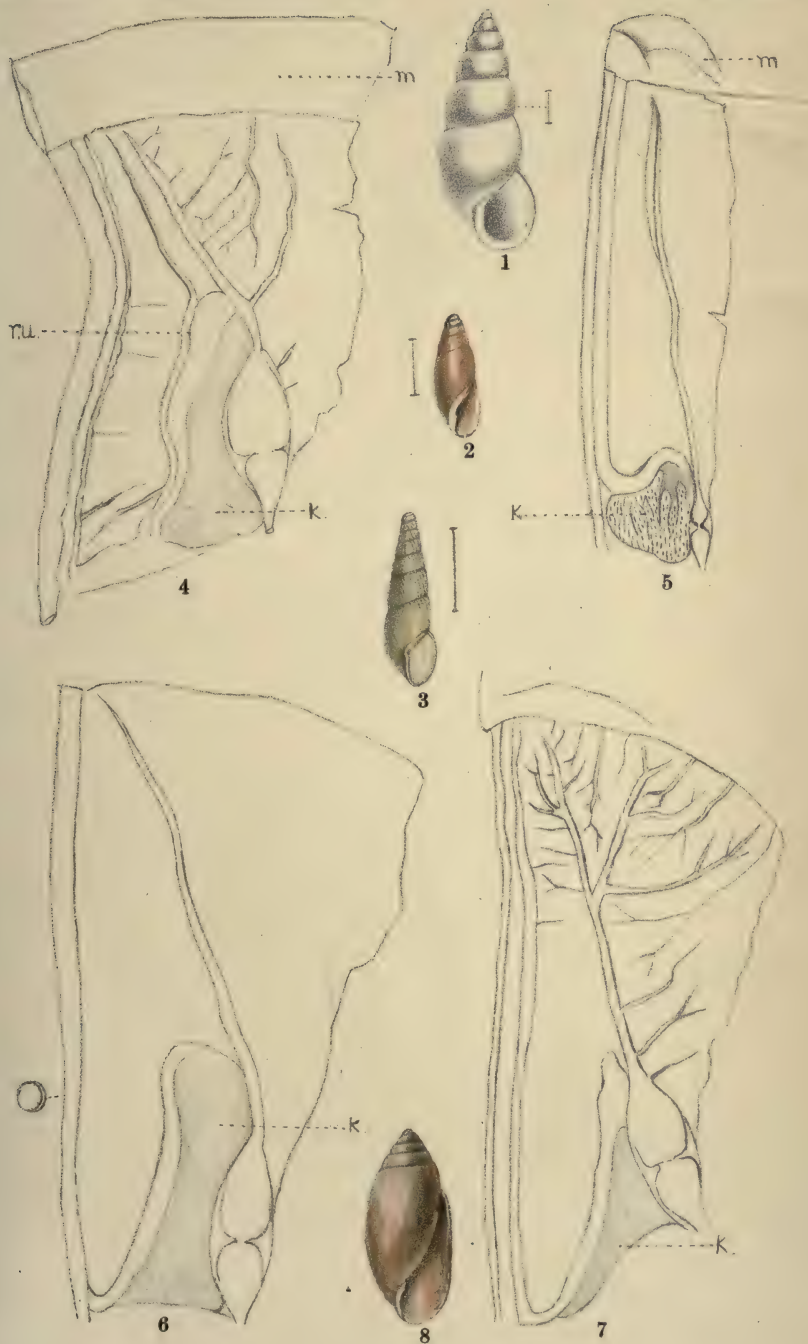
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